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CLARK, JOHN G., M.D.

COLEY, WILLIAM B., M.D.

GERSTER, JOHN C. A., M.D.

JACKSON, EDWARD, M.D.

STENGEL, ALFRED, M.D.

PUBLISHED QUARTERLY

BY

LEA & FEBIGER

706-710 Sansom Street

PHILADELPHIA

Awarded Grand Prize, Paris Exposition, 1900

PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE
MEDICAL AND SURGICAL SCIENCES

EDITED BY

HOBART AMORY HARE, M.D.

PROFESSOR OF THERAPEUTICS, MATERIA MEDICA, AND DIAGNOSIS IN THE JEFFERSON MEDICAL COLLEGE,
PHILADELPHIA; PHYSICIAN TO THE JEFFERSON MEDICAL COLLEGE HOSPITAL; ONE TIME CLINICAL
PROFESSOR OF DISEASES OF CHILDREN IN THE UNIVERSITY OF PENNSYLVANIA;
MEMBER OF THE ASSOCIATION OF AMERICAN PHYSICIANS, ETC.

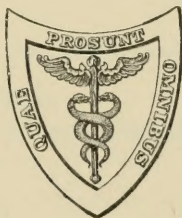
ASSISTED BY

LEIGHTON F. APPLEMAN, M.D.

INSTRUCTOR IN THERAPEUTICS, JEFFERSON MEDICAL COLLEGE, PHILADELPHIA; OPHTHALMOLOGIST TO THE
FREDERICK DOUGLASS MEMORIAL HOSPITAL AND TO THE BURD SCHOOL; INSTRUCTOR IN OPHTHAL-
MOLOGY, PHILADELPHIA POLYCLINIC HOSPITAL AND COLLEGE FOR GRADUATES IN MEDICINE

VOLUME II. JUNE, 1917

HERNIA—SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA—GYNECOLOGY—
DISEASES OF THE BLOOD. DIABETIC AND METABOLIC DISEASES.
DISEASES OF THE THYROID GLAND, SPLEEN, NUTRITION,
AND THE LYMPHATIC SYSTEM—OPHTHALMOLOGY.



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LIST OF CONTRIBUTORS

J. HAROLD AUSTIN, M.D.,

Associate in Medicine, University of Pennsylvania; Assistant Physician to the University Hospital, Philadelphia.

JOSEPH C. BLOODGOOD, M.D.,

Associate Professor of Surgery, Johns Hopkins University, Baltimore, Md.

CHARLES W. BONNEY, M.D.,

Assistant Demonstrator of Anatomy in the Jefferson Medical College, Philadelphia.

JOHN G. CLARK, M.D.,

Professor of Gynecology in the University of Pennsylvania, Philadelphia.

GEORGE M. COATES, A.B., M.D.,

Surgeon to the Out-Patient Department for Diseases of the Ear, Throat, and Nose of the Pennsylvania Hospital; Professor of Diseases of the Ear in the Philadelphia Polyclinic; Laryngologist to the Tuberculosis Department of the Philadelphia General Hospital; Consulting Laryngologist to the Philadelphia Orphanage.

WILLIAM B. COLEY, M.D.,

Professor of Clinical Surgery, Cornell University Medical School; Attending Surgeon to the General Memorial Hospital for the Treatment of Cancer and Allied Diseases; Attending Surgeon to the Hospital for Ruptured and Crippled, New York.

FLOYD M. CRANDALL, M.D.,

Consulting Physician to the Infants' and Children's Hospital; Late Visiting Physician to Minturn Hospital, New York.

EDWARD P. DAVIS, M.D.,

Professor of Obstetrics in the Jefferson Medical College of Philadelphia.

WILLIAM EWART, M.D., F.R.C.P.,

Consulting Physician to St. George's Hospital and to the Belgrave Hospital for Children, London.

CHARLES H. FRAZIER, M.D.,

Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University, Howard, and Philadelphia Hospitals.

JOHN C. A. GERSTER, M.D.,

Instructor in Operative Surgery, Cornell University; Adjunct Surgeon, Mount Sinai Hospital; Assistant Surgeon, Knickerbocker Hospital, New York.

EDWARD H. GOODMAN, M.D.,

Associate in Medicine, University of Pennsylvania; Assistant Physician, University Hospital and Philadelphia General Hospital; Consultant to the Medical Dispensary, University Hospital, Philadelphia.

WILLIAM S. GOTTHEIL, M.D.,

Adjunct Professor of Dermatology, New York Post-Graduate Medical School; Consulting Dermatologist to Beth Israel and Washington Heights Hospitals; Visiting Dermatologist to the City and Lebanon Hospitals, New York City.

EDWARD JACKSON, M.D.,

Professor of Ophthalmology in the University of Colorado; Ophthalmologist to the City and County Hospital of Denver.

H. R. M. LANDIS, M.D.,

Director of the Clinical and Sociological Departments of the Henry Phipps Institute of the University of Pennsylvania; Assistant Professor of Medicine in the University of Pennsylvania; Visiting Physician to the White Haven Sanatorium.

GEORGE P. MÜLLER, M.D.,

Associate in Surgery in the University of Pennsylvania; Professor of Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the St. Agnes and Polyclinic Hospitals; Assistant Surgeon to the Hospital of the University of Pennsylvania; Consulting Surgeon to the Chester County Hospital.

JOHN RUHRÄH, M.D.,

Professor of Diseases of Children and Therapeutics, College of Physicians and Surgeons; Visiting Physician, Robert Garrett Hospital, Nursery and Child's Hospital, Mercy Hospital; Consulting Physician, Church Home and Infirmary, Baltimore.

WILLIAM G. SPILLER, M.D.,

Professor of Neurology in the University of Pennsylvania; Clinical Professor of Nervous Diseases in the Woman's Medical College of Pennsylvania.

ALFRED STENGEL, M.D.,

Professor of the Theory and Practice of Medicine and Clinical Medicine in the University of Pennsylvania, Philadelphia.

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PROGRESSIVE MEDICINE.

JUNE, 1917.

HERNIA.

By WILLIAM B. COLEY, M.D.

Hernias of the Urinary Bladder.¹ Heineck,² of Chicago, discusses at considerable length the hernias of the bladder. The author begins by stating that "every surgeon is certain to meet with some instances of hernia of the bladder," and adds the opinion that "the urinary bladder in part, or in its entirety, is present in 1 per cent. of all hernias."

While this statement may be true if it is limited to large, fully-developed scrotal hernias in the male adult, I am sure it is not true if it refers to hernias in general, including hernia in children.

Heineck states that "many operators without their knowledge have punctured, incised, ligated or removed a herniated bladder-process and then closed the hernial canal and operative wound in the usual way. Bladder protrusions have been excised by mistake for hernial sacs, or stitches used to close hernial canals have been passed too deeply and found at the necropsy to have caught the bladder."

AGE. Apparently he found no cases in children, as shown by his table:

9 cases from 16 to 25 years of age.				
27	"	26 to 35	"	"
31	"	36 to 45	"	"
36	"	46 to 55	"	"
19	"	56 to 65	"	"
15	"	66 to 75	"	"
5	"	76 to 80	"	"

From his personal clinical observation and a review of the literature, Heineck concludes that hernias of the urinary bladder are extremely

¹ Heineck's article is based on an analysis of all the vesical hernias reported with sufficient data in the English, French and German languages from 1896 to 1914, inclusive, and also of some unpublished personal cases (159 patients representing 164 vesical hernias).

² Surgery, Gynecology and Obstetrics, May, 1916.

rare in infancy, childhood and adolescence. During the first year of life, not one patient, and previous to the sixteenth year, only 13 patients are reported to have been operated on for hernia of the urinary bladder. They are most frequent after the fortieth year of life. Ninety-one patients out of 159 unselected consecutive herniated individuals were operated on for the relief of this condition during the fifth, and subsequent, decades of life.

Bladder hernia are found much more frequently in males than in females. Of the 164 cases analyzed by Heineck, 62 were females, 96 males, one a masculine pseudohermaphrodite. In both sexes there seems to be a noticeable predilection of the hernia for the right side.

ANATOMICAL SITES. Oblique inguinal bladder hernia may be complete or incomplete, according to whether the bladder emerges beyond the external ring or is found within the hernial canal. It is complete when it enters the scrotum, or, in the female, descends into a labium majus.

Direct inguinal hernias of the bladder, while less numerous than the indirect, are relatively much more frequent. The author found 27 patients with direct inguinal hernias, and 87 with indirect or oblique inguinal hernia. Of the 27 patients with direct inguinal hernia, 5 were females. Of the 87 patients with indirect inguinal hernia, only 13 were females.

Forty-two femoral bladder hernias were found, of which 40 were in the female and only 2 in the male.

Of 114 inguinal bladder hernias, 27 were of the direct type.

Gladstone observed a case of obturator hernia of the bladder. Two cases of suprapubic bladder hernia of the linea alba are reported.

Bladder hernias are usually divided into three anatomical varieties: Intraperitoneal, with complete hernial sac; paraperitoneal, in which the herniated bladder process is covered by peritoneum on one surface; and extraperitoneal, in which the herniated portion of the bladder is neither engaged in, nor contiguous to, a hernial sac. Of the 164 cases reported, 4 were of the intraperitoneal, 53 of the paraperitoneal, and 58 of the extraperitoneal variety.

In the author's collection, there were 48 hernias the contents of which could be completely reduced; one-third of these were females, two-thirds males. Of 58 irreducible bladder hernias, 21 occurred in females.

ETIOLOGY. The etiology of bladder hernia differs little from the etiology of hernia in general. The causative factors, which perhaps deserve special mention, are: Poor development or atrophy of the aponeurosis of the transversalis muscle and of the conjoined tendon, unusually large external hernial rings and abnormal amount of extraperitoneal fat in the region of the hernial opening; all conditions which tend to weaken the abdominal wall, especially obesity.

SYMPTOMS. These are seldom characteristic, as is evidenced by the fact that the diagnosis is rarely made until the time of operation, and not always then.

The condition is one that usually occurs late in life, associated, in most cases, with hernias of considerable size. Pain is not infrequently

a symptom of bladder hernia. There is often difficulty in urination, frequency of urination and painful urination; but, in general, it may be said that the symptoms are not sufficiently pronounced to cause the patient to consult a physician.

The wall of the herniated bladder-process may be normal, thinned or thickened. The herniated bladder-process may present the appearance of an empty or of a thickened hernial sac. Its cavity usually communicates with the main cavity of the bladder by means of an opening varying in size. In some cases this portion of the bladder has been found the seat of tuberculous disease, and calculi have been found in the hernial portion of the bladder.

The following symptoms, if found before operation, might be suggestive of bladder hernia:

1. Urinary disturbances: Dysuria, two-stage urination, frequent urination, scalding urination.

2. A hernial swelling, pressure of which causes a desire to urinate, and which increases in volume with urinary retention, and markedly diminishes in size with urination.

3. A hernial swelling—the size of which is increased by air—or water distention of the urinary bladder.

4. A hernial swelling in which fluctuation is detected or in which a metallic sound can be introduced by way of the urethra.

5. A hernial swelling in which, after easy reduction of most of the contents, there persists a small, doughy mass representing the extruded part of the bladder.

During the course of a hernia operation, the following symptoms or signs are suggestive of vesical hernia:

1. An unusual amount of fat in the neighborhood of a hernial swelling.

2. Difficulty in finding or in isolating the true hernial sac from the tumor mass.

3. The trabeculated appearance of the bladder muscularis.

4. Large-sized external hernial opening and the fact that hernias of the bladder are usually nearer the median line than true hernial sacs.

5. The occurrence of a second hernial sac is so rare that it is a safe rule to regard as the urinary bladder, until proved otherwise, any structure resembling a second hernial sac.

6. The pedicle of a herniated bladder-process leads down behind the pubic bone into the true pelvis; the pedicle of a true hernial sac leads to the general peritoneal cavity.

Passage of sound into a cystocele, cystoscopic confirmation of its existence, escape of urine following wounding of bladder (31 cases)—all these are conclusive signs.

It should be borne in mind that vesical hernias are frequently associated with intestinal and omental hernias.

In many of the cases in which the bladder has been injured, the accident has not been noticed by the operator and has been discovered only several hours or days later, by the patient's voiding urine stained with blood, or the escape of urine from the abdominal wound, or peritonitis due to urinary extravasation.

TREATMENT OF BLADDER HERNIA. The treatment of this type of hernia, if the hernia has been recognized early in the operation, before any damage has been done to the bladder, does not vary from that of any other hernia.

In his 163 hernias in 158 subjects, the bladder was accidentally injured in 68 cases; in 31, urine escaped into the field at the time of the operation.

Injury of the bladder during a hernia operation is an accident which, I believe, should seldom occur in the hands of a careful operator. The following rule has been observed by us for many years in the cases of bladder hernia that have come under our observation.

In almost all cases there has been an unusual amount of extra-peritoneal fat, closely associated with the sac, particularly the upper portion of the sac. In such cases one ought to be on one's guard and not dissect the sac too high up. If this plan is carried out, we believe the bladder will very seldom be injured. In proof of this we might state that at the Hospital for Ruptured and Crippled, in a total of 5617 operations, 11 of which were bladder hernia, not a single accident of this kind has occurred. It is true that a very large proportion of these cases were children—(693 were adults, 4924 children). In addition, we have operated upon 1500 adult patients outside of the hospital, without injuring the bladder.

Should one be so unfortunate as to injure the bladder, it is important to know what procedure to carry out:

The bladder should be immediately and carefully sutured with an absorbable suture, preferably catgut or fine kangaroo tendon, then drainage should be placed in the hernial wound, extending down to the bladder suture line. The drain should be of rubber tissue, not gauze. Some operators prefer, after suture of the bladder, to leave the abdominal wound open at the lower angle, closing it later, but this I believe unnecessary. In cases in which the injury of the bladder is not discovered until several hours or a day or more have elapsed, the wound should be reopened and the injury repaired, if possible, and the abdominal cavity drained. If the wound is intraperitoneal and there are signs of beginning peritonitis, laparotomy should be performed.

MORTALITY OF BLADDER HERNIA. In Heineck's series of 163 cases in 157 subjects, there were 12 deaths. In 13 cases a urinary fistula complicated convalescence. In most of the fatal cases the wound of the bladder had not been recognized immediately. The danger plainly exists in the late recognition of the accident.

Lumbar Hernia. Goodman and Speese,¹ of Philadelphia, give an admirable review of the literature of lumbar hernia and report a case that has come under their own observation. They found reports of 33 cases of acquired lumbar hernia, 11 congenital and about 40 cases following local injury and disease. The early writers on hernia fail to mention this variety. Pierre Franco, in his *Traité des Hernies* published in 1561, describes only inguinal hernia. The first reference to

¹ Annals of Surgery, May, 1916.

lumbar hernia seems to have been made in the latter part of the seventeenth century—between 1672–1687. Paul Barbette at that time stated “Experience has taught me that the peritoneum may rupture in its posterior aspect toward the back, thus forming a hernia.” The old idea, according to which hernia is due chiefly to a rupture of the peritoneum, seems to have been of very early date. As a matter of fact, in neither lumbar hernia nor practically any other type of hernia, is the peritoneum ruptured, but rather stretched and pushed forward in front of the hernial protrusion.

Blancard, in 1701, refers to the possibility of lumbar hernia, but does not describe a case. Goodman and Speese state that the first trustworthy observation on record is that of Garangeot (1731) who mentions a case of strangulated hernia, reducible after death. Although he made no autopsy, there is little doubt that it was a case of true lumbar hernia. Ballin, in 1768, writes “lumbar hernia may arise unexpectedly between the false ribs and the crest of the ilium, at the point where the external oblique is attached only by a cellular tissue.” The site at which the hernia occurs is usually called “Petit’s triangle,” although a number of later writers dispute his claim to the honor, some other surgeons before his time having described the condition nearly as fully or more so. Coming down to a later date, it appears that Grynfeldt (1866) studied the subject more fully than any of his predecessors. He described the anatomical conditions much more exhaustively and accurately. He states “The aponeurotic fibers of the transversalis in dividing form a passage for the lower intercostal artery, just as the spermatic cord enters the two pillars of the external ring. There is at this point a natural point of lessened resistance. If the lower border of the internal oblique inclines more anteriorly than normally, the last intercostal artery perforates the aponeurosis of the transversalis above the border. In other words, if the point of resistance of this artery is in the lumbo-costo-abdominal triangle, all the conditions favoring a hernia are realized.” Grynfeldt’s space is a little different from Petit’s; it is bounded above by the twelfth rib, internally by the quadratus lumborum, externally by the external oblique and below by the internal oblique muscle.

Four years later, Lesshaft, without mentioning Grynfeldt’s work, described the same space, and in Germany it is generally known as Lesshaft’s triangle, but its proper name should be the Grynfeldt-Lesshaft space. Lesshaft studied 108 adult cadavers and found Petit’s triangle present in 84. The triangle was present nine times in 34 embryos or newborn. In other words, the triangle is generally recognized in adults, but rarely in children. At the Hospital for Ruptured and Crippled we found it in but 1 case, a child of nine years.

Goodman and Speese made numerous dissections having reference to Petit’s triangle and to the triangle of Grynfeldt, and of 76 examinations Grynfeldt’s triangle was missing, 12 times on both sides and 4 times on one side only. In other words, it existed in 63.13 per cent. of the cases. The size of the triangle varies a great deal; often it is merely a slit, and again having a base 5 or 6 cm. wide. The Grynfeldt-Lesshaft

triangle was present in 93.5 per cent. of the dissections, and the authors regard it as an almost constantly occurring weakness in the lumbar region. The space is not always that of a triangle, it may be trapezoid or polyhedral. The most common form is an acute-angled quadrilateral, or a triangle. The thickness of the aponeurosis varies in this space but at the uppermost limit the thinnest portion of the lumbar region is seen. In this thin area, vessels and nerves are found, usually the twelfth intercostal, and it is in this region that hernias most often occur.

In regard to the cause of lumbar hernia in the cases referred to in the paper, the authors have ruled out all cases following a direct injury, or that were secondary to infectious processes, sinus formation or visceral protrusions due to muscle paralysis; only cases that resulted from indirect traumatism are considered. By indirect traumatism the authors mean habitual or sudden strain, lifting of heavy weights, coughing and the strain following falls. In 14 of 33 cases the hernia appeared soon after the injury. Whether or not there was a congenital sac or congenital weakness in these cases prior to the injury, is a question that cannot be settled. There is no positive evidence that this was so. The various predisposing causes often found are emaciation, old age, repeated pregnancies or anything that tends to lower the muscular tone. As regards the age of the patients, 5 cases were below 40 years, 4 in each of the three succeeding decades.

For some reason, not entirely clear, the greater number of cases of lumbar hernia are found on the left side, 19 being noted on the left, 2 on the right side; 2 were bilateral. There is also a greater predisposition to hernia in males than in females, 22 being reported in males, 9 in females.

COVERINGS OF THE HERNIA. Usually, in well-developed cases, a lumbar hernia is covered only by the skin, but in some instances there is an additional layer of fat or muscle. Goodman and Speese state that "there is considerable doubt concerning the formation of a sac, for it has been distinctly noted at operation and at postmortem that a sac composed of peritoneum is often lacking. This seems to be particularly the case in the hernias composed of fat protruding from the subperitoneal or perinephritic tissues." In the only case that we have personally observed, there was a peritoneal sac.

CONTENTS OF THE HERNIA. The contents may be fat, large and small intestine, and in rare cases, the kidney. The hernia is nearly always reducible, even when strangulation has occurred. Jeannel believes that hernias due to effort or to trophic changes in the muscles present themselves in Petit's triangle or in the Grynfeltt-Lesshaft space, while traumatic hernias and those due to disease may occur anywhere. In the cases in which the hernia has been sufficiently accurately described to determine in which triangle it occurred, 6 were found in the Grynfeltt-Lesshaft space, 9 in Petit's triangle.

As regards the symptoms, these depend largely on the size of the hernia. In Goodman and Speese's case there were no symptoms at all until the hernia had developed sufficiently to form a noticeable

tumor. In some cases there is a feeling of fatigue and pain in the back at the end of a day of hard work. The hernia develops very slowly and often attains considerable size before the patient is aware of its presence. In some cases, errors in diagnosis have been made; in 1 case cited by the authors, the bowel was opened and a fecal fistula resulted.

Jeannel found strangulation in 18 per cent. of the cases, which is a very high percentage. In 33 cases of spontaneous hernia collected by Goodman and Speese, strangulation occurred 8 times (24 per cent.). The condition is one that can be very successfully dealt with by operation and a cure is usually permanent. In the absence of contra-indications in the way of advanced age, or poor general condition, radical operation should be recommended.



FIG. 1

The patient personally observed by Goodman and Speese, and reported in their paper, was fifty-eight years of age. He was admitted to the Presbyterian Hospital in October, 1915, on account of nephritis. Examination at the hospital revealed the presence of a hernia, of which

the patient had not been aware. He was a stone mason by occupation and accustomed to hard work. The tumor was found in the left lumbar region just under the last rib; it was 3 cm. in diameter, rounded and painless; percussion showed it resonant, and auscultation revealed peristaltic sounds. Careful physical and x-ray examination led the authors to believe that the contents of the hernia was the small intestine. They advised against operation, however, on account of the patient's age and the accompanying nephritis, and especially for the reason that the presence of the hernia caused him no trouble or discomfort.

In regard to the etiology of congenital lumbar hernia, the writers state that "the etiology of this form of hernia is unknown, unless it be due to congenital malformation." My own opinion—if I am at liberty to express it—is that lumbar hernia is due to congenital causes. Imperfect development of the muscles in the neighborhood of the triangles mentioned, is the main and underlying cause. In addition to this, there may be present the exciting cause of repeated strains or repeated periods of increase of intra-abdominal tension due, *e. g.*, to chronic bronchitis, strain in stool. Large bowel, small intestine, kidney, have all been found in this type of hernia. Congenital lumbar hernia is, of course, incurable by mechanical measures and should always be operated upon, unless there be pronounced contra-indication.

In conclusion, the writers give a brief description of 31 cases of congenital lumbar hernia reported in literature.

Umbilical Hernia. Channing C. Simmons,¹ of Boston, has made a very valuable study of the end-results in 70 consecutive cases of umbilical hernia operated upon at the Massachusetts General Hospital between the years 1909 and 1914. The end-result was obtained in nearly every case. The time that elapsed since the operation to the report of the cases, varied from 1 to 4 years. Simmons calls attention to the fact that most hernial recurrences take place within a few months or a year after operation, and states that the end-results in 146 cases of inguinal hernia with 13 recurrences, reported by himself in 1910, showed that every recurrence took place within a year, and most of them within a few months.

This confirms the opinion expressed by Dr. Wm. T. Bull and myself more than twenty years ago, based upon a study of 165 cases of relapses following operations for different varieties of hernia observed in the out-patient department of the Hospital for Ruptured and Crippled.

Simmons divides his umbilical hernias into three groups:

1. Small congenital umbilical hernia in children, and small hernias in adults which were operated upon incidentally in the course of another operation, but for which the patient did not seek medical advice. There were 15 cases in this group.

2. The typical cases of large umbilical hernia of slow growth in stout, middle-aged adults, usually women—43 cases.

In 19 of these, complications were present, and in 12 some other operation had to be performed at the same time. Four had cardiac

¹ Boston Medical and Surgical Journal, March 9, 1916, p. 342.

insufficiency, 2 were ulcerated, 2 had been previously operated upon for hernia, and 1 had a large goitre.

3. Strangulated hernia—12 cases. Some of these were typical cases of strangulated hernia with congested or gangrenous gut. Several, however, might more fittingly be termed irreducible incarcerated hernias.

There were three different types of operation used in the cases reported. (1) Closure of the ring by suture vertically with or without the overlapping of the aponeurosis. (2) Transverse closure of the ring without overlapping of the aponeurosis. (3) Transverse closure with overlapping of the aponeurosis, the Mayo operation.

Simmons states that he has always personally employed the Mayo operation, without recurrences up to the present time, and, although the number is relatively small, it is still sufficient to prove the advantages of this operation over all others. In carrying out the technic of the Mayo method, he overlaps from above downward and uses Pagenstecher's mattress sutures. He states that special care should be taken in closing the ends of the wound, as it is at this point that recurrence is particularly likely to take place.

This technic is practically the same as that employed by us at the Hospital for Ruptured and Crippled, except that we have always used chromicized kangaroo tendon for our buried sutures.

Simmons states that he has had considerable trouble with collections of serum in the loose subcutaneous tissue, appearing on, or about, the tenth day, and which usually have to be evacuated; often slight skin sepsis results with the formation of a sinus persisting for a longer or shorter time. He now believes this complication can be best avoided by the use of a rubber drain introduced to the main wound through a stab wound in the side. The drain should be left in from 4 to 7 days. The patients are kept in bed for from 18 to 21 days after operation.

Personally, I do not believe stab-wound drainage at all necessary, if cigarette drains—2 to 3 in number, according to the size of the wound—are introduced at the outer corners, and, in extensive wounds, also in the middle. In this way free drainage is established, and the accumulations, referred to by Simmons, do not take place and primary wound healing is the result. This has been our experience at the Hospital for Ruptured and Crippled.

The results of operation in the different groups were as follows:

Group 1 (fifteen cases—children and small hernias in thin adults). Four could not be traced; 1 died of intercurrent trouble. The remaining 10 were all well and without recurrence. In 1 the ring was closed transversely; in 3, transversely with an overlap, and, in 6, vertically. Chromic catgut was used as suture material in all but 1 case.

Simmons states "it makes little difference what operation is performed in cases of umbilical hernia in children, a cure is always to be expected."

We agree with this, but would go even further and say that any operation in umbilical hernia in children is contra-indicated, except in the very rare cases in which the opening is of extreme size. Practically

all cases of umbilical hernia in children can be cured by mechanical treatment. The best and simplest method we have found to be the application of a wooden button mold, covered with zinc oxide plaster held firmly in place by a strip of 2-inch rubber plaster entirely encircling, but not constricting, the abdomen, this to be changed every week or ten days.

Group 2 (stout adults). Forty-three cases, of which 2 died following operation, 1 of shock, but in this case the hernia was complicated with a hysterectomy. As the hernia was small, and the hysterectomy the main operation, death can hardly be counted as due to the hernia. The other death occurred in a very stout woman with a systolic murmur and an incarcerated hernia. Mortality: 1 in 42, or 2.4 per cent. The result of operation is unknown in 2 other cases, leaving 39 cases from which conclusions may be drawn. Simmons adds to these 6 cases of strangulated hernia who survived the operation and in whom at the time of operation an attempt was made to cure the hernia.

Of these 45 cases, in 10 the hernia recurred—22.2 per cent. of the cases. In the 30 cases in which the Mayo operation was performed, there were 3 recurrences, or 10 per cent.; in the 14 cases in which the ring was closed vertically, with or without overlapping, 6 recurred, or 42.8 per cent. Eleven cases operated upon by Simmons personally, showed no recurrence. The proportion of recurrences was not larger in the cases associated with local sepsis, than in the clean cases.

Group 3 (strangulated hernia, 12 cases). In 9 of these an attempt was made to cure the hernia; 2 died following the operation. These 12 cases of strangulated hernia were operated upon by nine different surgeons. All but 1 case with cirrhosis of the liver were stout, and all were elderly adults. The youngest was forty-four years, the oldest eighty years. There were 3 deaths in this group; one patient, seventy-five years of age, died of postoperative pneumonia on the second day after operation; 1 case in which the sac contained ruptured gangrenous gut, died of peritonitis 12 hours after operation; case 3 died suddenly four weeks after operation, presumably of pulmonary embolism.

Simmons' conclusions are as follows: Small umbilical hernia in thin adults, and umbilical hernia in children, may be cured by any operation which removes the sac and closes the defect in the abdominal wall.

Cases of umbilical hernia in stout adults are difficult to cure. The Mayo operation, of transverse closure of the ring, with an overlap of the aponeurosis, gives the best results.

In adults, closure of the ring by any other method than the Mayo, in a general hospital, is followed by 46.4 per cent. of recurrence.

Recurrence, if it is to take place, usually does so in less than one year.

The suture material employed has no relation to the liability to recurrence.

Skin sepsis is very likely to occur, but, apparently has no relation to recurrence.

With most of Simmons' conclusions I am in entire accord, but with

his statement that "the suture material employed has no relation to the liability to recurrence," I cannot agree. I believe that proper suture material has an extremely important relation to the permanency of the cure. No unabsorbable suture material should be employed in any form of hernia, but the suture should remain unabsorbed sufficiently long to permit firm healing of the wound. I believe that the suture which most nearly fulfils these requirements is chromicized kangaroo tendon—chromicized sufficiently to remain in the wound for a period of 3 or 4 weeks.

McGlannan,¹ of Baltimore, contributes a valuable article on the subject of "MASSIVE UMBILICAL AND VENTRAL HERNIAS." To form some guide to classification, he states that he distinguishes as "massive hernias" those whose ring has a circumference of not less than 40 cm., or a cavity of 500 cm., also smaller hernias occurring in obese individuals whose pendulous abdominal walls require the removal of an area of skin and fat not less than 10 cm. in its short diameter. McGlannan very correctly states that these massive hernias present a problem much more complicated than that associated with simple inguinal hernia. Not only are the technical details of the operation much more difficult to carry out, but the mortality connected with the operation is very much greater. He cites a series of 1900 non-strangulated hernias, with but 4 deaths, or a mortality of a little over 0.2 per cent., while in a series of 197 umbilical and ventral hernias operated upon by the same group of surgeons in the same period of time, there were 6 deaths, or a mortality of 3 per cent. In the same series there were 46 massive hernias with 3 deaths, or a mortality of 6 per cent. When strangulation complicates the condition, the death-rate rises to 50 per cent., as against 26 per cent. in all other forms.

The paper is based upon a series of 26 cases treated at the surgical clinic of St. Agnes's Hospital and from McGlannan's service at the Mercy Hospital. In this series there were 4 strangulated hernias, with 2 deaths. Of the remaining 22 non-strangulated cases, 1 died on the second day from dilatation of the heart. In 16 cases other complications were present; 6 had heart lesions, 6 renal, 2 arteriosclerosis, 2 obesity. The average confinement in bed after operation for inguinal hernia was 12 days, and the stay in the hospital 19 days; after massive hernia the average is 31 days in bed and 48 days in the hospital, the extremes varying between 21 and 125 days.

The CAUSES OF DEATH in the massive hernias he places in three groups: (1) those due to cardiovascular conditions; (2) postoperative abdominal conditions, including postoperative obstruction, acute dilatation of the stomach, peritonitis, infection; (3) those due to strangulation; toxemia of obstruction, peritonitis from ruptured and gangrenous bowel, embolism of the mesenteric arteries.

In the non-strangulated hernias, he believes that *acute cardiac dilatation* is the most common fatal complication. This is due to the fact that in these hernias the patients carry a considerable portion of their

¹ Surgery, Gynecology and Obstetrics, 1915, p. 700; Transactions of Southern Surgical Association, December, 1914.

viscera outside the normal limits of this cavity. There is consequent loss of pressure on the large splanchnic vessels which results in the dilatation, and is associated with compensatory changes in the general circulation which sustains the normal blood-pressure. The return of these large masses of viscera to the cavity, and tight closure of the hernial orifice, adds very greatly to the work the heart must perform. This is a great burden for the normal heart, but almost certainly fatal in these cases of massive hernia in which the heart is weakened by various degrees of myocarditis.

Renal insufficiency is another source of danger. He believes that careful preoperative treatment will greatly reduce the danger of these complications; hence the patients should remain in the hospital a considerable period before operation. The high mortality in the strangulated cases is in part due to the fact that operation had to be performed immediately, without the important preliminary treatment.

The preliminary treatment advocated by McGlannan is a modification of that suggested by Johannes Hahn. The patient is put to bed, the blood-pressure is recorded two or three times a day and a phthalein test for the kidney function is made. A binder is snugly applied to the abdomen, padding the hernia, should this be irreducible. The binder is gradually tightened and the effect of this on the blood-pressure, heart action and respiration noted. The pressure of the bandage is increased as rapidly as it can be tolerated by the patient, and, later, small flat sand-bags applied under the bandage add to the pressure. During this procedure the hernia, if reducible, is retained by a pad pressed into the opening, and, if irreducible, is so surrounded by cushions of cotton and gauze that the pressure does not increase the amount of its contents.

Respiratory difficulty, rapid change in blood-pressure, irregularity of the heart, and gastro-intestinal disturbances are signals for the relief of pressure, and against any operative procedure. The diet is limited to soft food, without milk. If the kidney function is inhibited, as shown by the phthalein excretion, the patient is given large quantities of dilute cream of tartar solution, and the intake and output of water recorded. The preliminary treatment may last from a few days to one or two weeks.

In operating upon strangulated massive hernia, he believes that, if the patient is not already in a toxic stage of obstruction, immediate closure should be the method of choice. If the patient has reached the toxic stage, the two-stage operation is the only one to be considered. Rapid removal of the contents of the obstructed loop of bowel by an enterostomy is the important indication in these cases. With gangrene added to obstruction, the extent of operation will vary from enterostomy with extrusion of the gangrenous bowel, to resection and anastomosis according to the degree of toxemia. He advises making an enterostomy above the point of obstruction. If the gangrenous loop is high in the small intestine, the lateral anastomosis between the upper and lower healthy areas should be made at the primary operation, even in toxic patients. The end of each segment is left open or sutured around

a rubber tube, draining the obstructed loops. The anastomotic opening provides a channel through which some nutritive material may pass down the intestine during the closure of the bowel ends, and, as soon as the toxemia is relieved, it is possible to close these ends by simple suture.

Hahn advises the two-stage operation even in the absence of toxemia and obstruction.

Personally, I would very strongly advise the two-stage operation in the more serious cases. I am sure that in one or two of my fatal cases the patient would have survived, had I performed a two-stage, instead of a one-stage, operation.

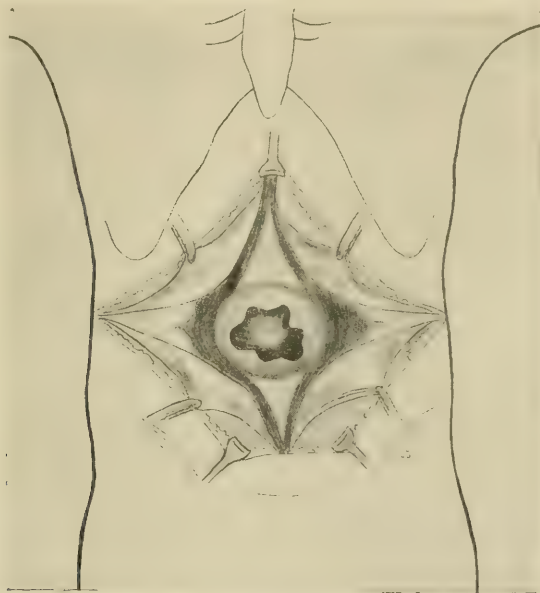


FIG. 2.—Showing the four flaps of fascia, and the opening of the rectus sheath, preparatory to the suture.

McGlannan cites one very interesting case of massive strangulated umbilical hernia, done by Bloodgood under novocaine infiltration. The patient was a woman of fifty-two, very fat, with an enormous hernia strangulated for 12 hours, suffering from toxemia, cyanosis and failing heart. The constriction was divided and a lateral anastomosis made beyond the gangrenous segment which was then excised. The divided ends were left open and a rubber tube sutured in each of them. The peritoneum was closed around the extruded ends and the wound packed with gauze. Under the usual treatment, the patient recovered rapidly from the toxemia. The radical operation for the hernia was performed two months after the strangulation. The patient is well, two and one-half years after the operation.

For a detailed description of the technic of the operation performed

by McGlannan whenever possible, the reader is referred to the original article.

LIPECTOMY. Lipectomy, or the removal of a large amount of fat in connection with umbilical hernia, has been advocated by many surgeons, particularly by Dr. Kelly, of Baltimore, in 1910, and has been recently urged by Walter Lathrop.¹ Lathrop advises an elliptical incision beginning well over on the side and extending to the corresponding point opposite, while its center below is a few inches above the pubis, and the upper above the umbilicus. Of course, the incision must vary according to the amount of tissue to be removed; it should go down to the fascia and then the whole amount of tissue in the area should be removed. He advises wiping out the wound with 3 per cent. iodine before closing, not forgetting to provide drainage. He states all bleeding should be carefully controlled and exact apposition of the wound should be secured. Provision for drainage at each end of the large incision—which is often neglected—is most important, from the point of technic, as there is oozing of blood and serum and fatty debris which, if allowed to accumulate, often causes breaking down of the wound and greatly prolongs convalescence.

The after-treatment consists of rest in bed from 18 to 20 days. The diet is chiefly milk in small quantities and water and lemon juice. One case, referred to by Lathrop, lost 65 pounds in a few weeks, including the amount excised. Lathrop removed 16 pounds from one patient; four months later, from diet, she has lost 30 pounds and was in good health.

Kelly advises removing wedges of skin and fat in patients who are not troubled with obesity, but simply for getting rid of part of the thickness of the abdominal wall and making the field of operation more accessible.

Gibbon, of Philadelphia, has reported a case of lipectomy in a patient weighing 315 pounds. An incision 38 inches long was made and a portion of fat removed, weighing 21 pounds. It is interesting to note, however, that six months later, the same patient came under the hands of another doctor and again weighed 315 pounds, and, under medication and diet, was reduced to 265 pounds.

Lathrop's personal experience is based upon 103 cases of umbilical hernia, in 57 of which some portion of fat was removed. In 46, a regular lipectomy operation was done. In 89 cases there was no mortality. In 13 cases of strangulation there were 4 deaths. The average amount of fat removed was $5\frac{1}{2}$ to 6 pounds.

In the discussion of Lathrop's paper, Babcock, of Philadelphia, recommended the use of alien substances, particularly silver in the form of filigree, as suggested by Bartlett. He calls attention to the unfortunate defect that, as time goes on, the silver strands tend to fragment and possibly cause pain. To overcome this, he states, he has during the last two years laced the deep layers left weak after imbrication and sutured with a continuous lacing, as we lace a shoe, with a fine silver chain having a caliber of about No. 2 catgut.

¹ Journal of American Medical Association August 12, 1916, p. 487.

We have already emphasized so frequently, in *PROGRESSIVE MEDICINE*, the disadvantages of using any non-absorbable suture or wire filigree in hernia operations, that it seems unnecessary to repeat these objections. Not only does the silver wire in time break up into small fragments which become painful, but some of these fragments occasionally force their way into the bladder, and become the starting-point of calculi. We still believe that chromicized kangaroo tendon is the best suture material for any form of hernia, and, with this suture, any hernial opening which it is justifiable to operate upon, can be satisfactorily closed. We have made it a practice for many years, to remove the redundant portion of fat in connection with operations for umbilical hernia. The overlapping method of Mayo's still gives by far the best result.

Undescended Testis. Eisendrath,¹ of Chicago, discusses the subject of the undescended testis, which is always closely related to that of hernia, inasmuch as the two conditions are usually associated. He gives a brief review of the various theories as to the causation of the undescended testis, which we have already described in detail in earlier numbers of *PROGRESSIVE MEDICINE*. He is in accord with most other observers when he states that "as a rule every case of arrested or ectopic testis is accompanied by an inguinal hernia of the indirect variety, the sac of which is subject to as many variations in contents as any other inguinal hernia. In 2 out of his 38 operations, a sliding hernia of the cecum and appendix was found.

In regard to the indication for operation, he states that the general tendency at present is to advise operation at an earlier age than formerly. His opinion is that if the testis is within the inguinal canal, or just beyond the external ring, and cannot be brought well down into the scrotum, the operation should be done at as early an age as is compatible with the general condition of the child. He has operated at as early an age as two and one-half years and does not believe anything is to be gained by waiting until the age of ten to fourteen years, because of the well-recognized lack of development of the secreting tissues in the retained testis. He further states that if the testis lies within the abdomen and does not enter into the canal when the child coughs or strains, he also operates much earlier than formerly. In adults, he advises operation, because of the danger of torsion and tumor formation, and on account of the accompanying hernia. The prognosis as to a possible recovery of spermatogenesis is not very good. He believes that too little attention has been directed to a possible interrelation between the various degrees of hypopituitarism and the non-descent of the testis.

Personally, I do not believe the advice to operate on the undescended testis at the early age of two and one-half years, is well-founded. At the Hospital for Ruptured and Crippled we have for many years considered it better not to operate in children under the age of ten to twelve years, unless the accompanying hernia was of considerable size

¹ *Annals of Surgery*, September, 1916.

and held with difficulty by mechanical means. In many instances the accompanying hernia required an earlier operation, but, in the ordinary cases, we have believed it wise to wait, and many times we have seen the testis come down into the scrotum and develop normally just before

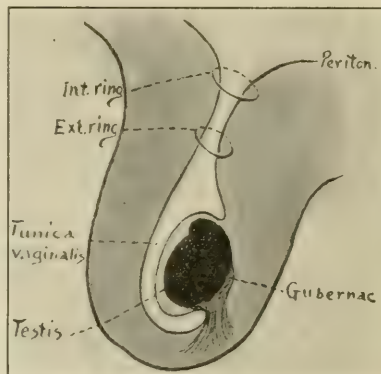
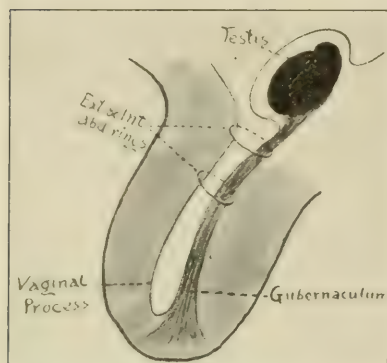


FIG. 3.—Various positions of retained (arrested descent) testis. Note location of abdominal, inguinal and upper scrotal testes.

the age of puberty without requiring an operation to cure the hernia. Increasing experience (we have now operated upon 306 such cases) has, however, led us to modify, in a measure, our earlier views, and this in the direction of earlier operation, although we seldom operate under the age of seven or eight years. The chief reason for operating—in

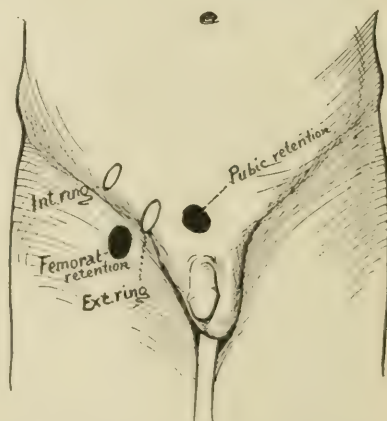
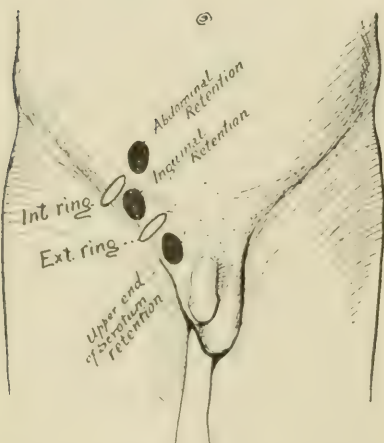


FIG. 4.—Location of pubic and femoral forms of ectopic or abnormally descended testis.

addition to that of bringing the testicle into the scrotum, is that a radical cure of the accompanying hernia may be obtained.

Eisendrath's illustrations are excellent. The operation that he describes is that devised by A. D. Bevan, already referred to in former

articles of PROGRESSIVE MEDICINE. This operation we believe to give the best results of any that has been used, but, like Eisendrath, we sel-

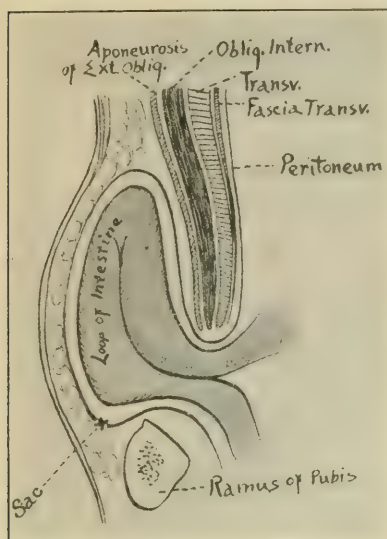


FIG. 5.—Relations (sagittal view) in subcutaneous form of interstitial hernia.

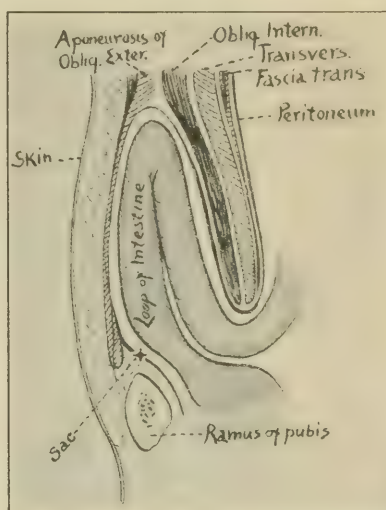


FIG. 6.—Relation in interparietal form of interstitial hernia.

dom found it necessary to ligate the accompanying veins as advocated by Dr. Bevan in his earlier paper. Dr. Eisendrath, in his series of 38

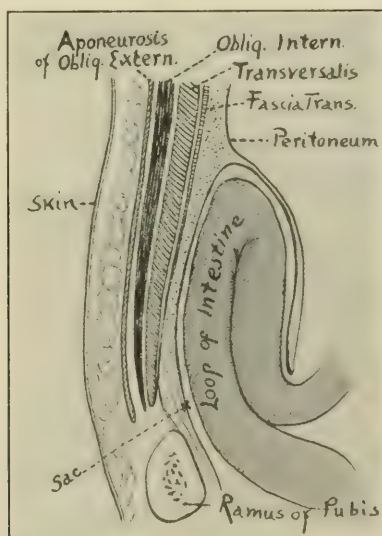


FIG. 7.—Relations in properitoneal form of interstitial hernia.

operations, found it necessary in but 2 instances to ligate the veins or vessels accompanying the vas.

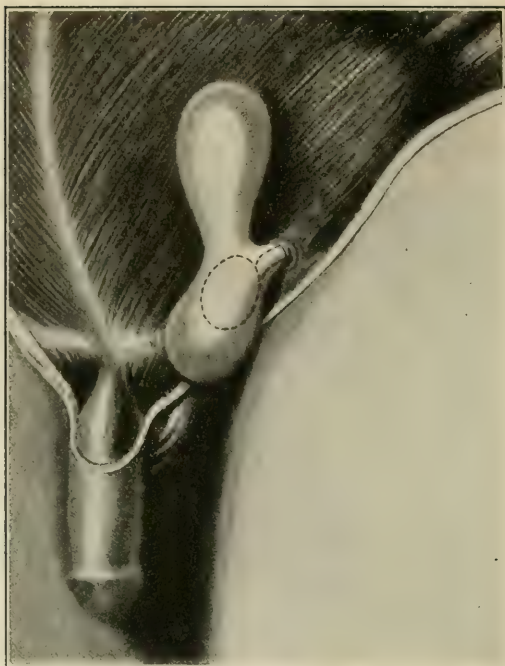


FIG. 8.—Subcutaneous form of interstitial hernia associated with non-descent of the testis (author's case). Note hour-glass form of the sac, the testis lying in the lower half, its position indicated by the dotted line.

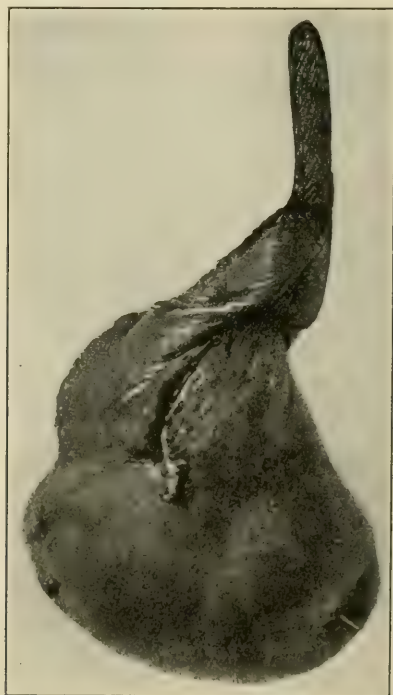


FIG. 9.—Torsion of testis (own case). Note black hemorrhage color of testis and epididymis.

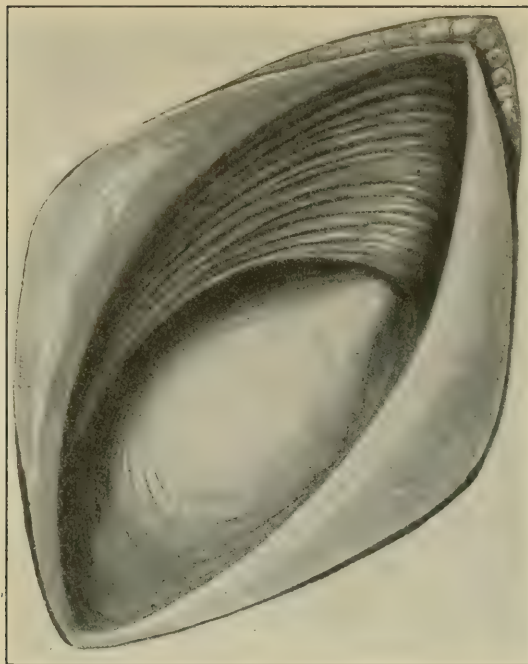


FIG. 10.—Note faulty development of conjoint tendon and of the internal oblique. External oblique aponeurosis divided and retracted to expose unopened sac and testis (on outer aspect of sac) lying in inguinal canal.

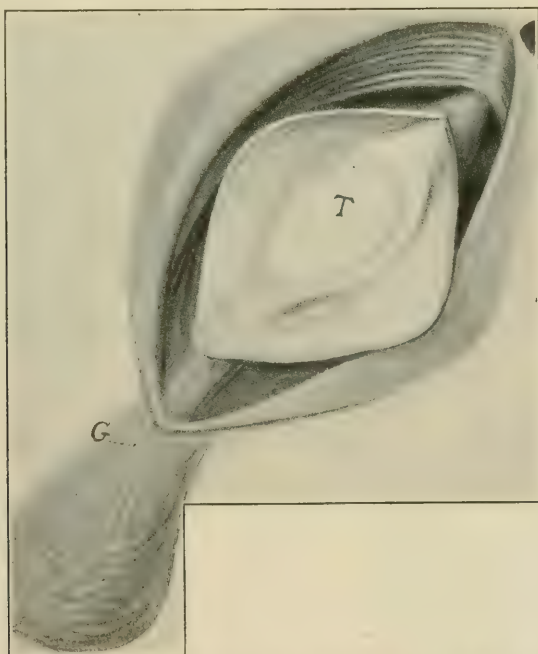


FIG. 11.—Sac opened, showing testis (*T*) protruding into sac, but outside of it. A well-developed gubernaculum (*G*) is shown extending from lower end of testis to lowermost portion of scrotum.

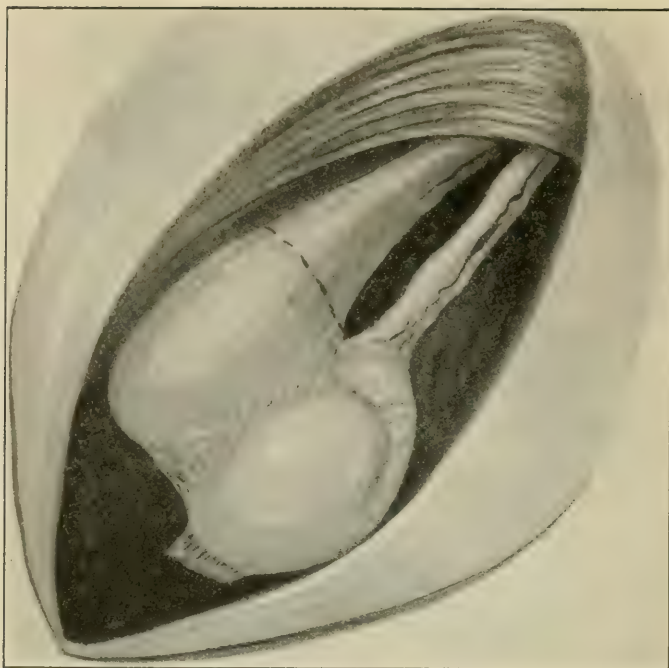


FIG. 12.—Vas and spermatic vessels separated from sac. Dotted line indicates level of division of sac before everting distal portion around testis (see Fig. 13). Gubernaculum has been divided close to testis.

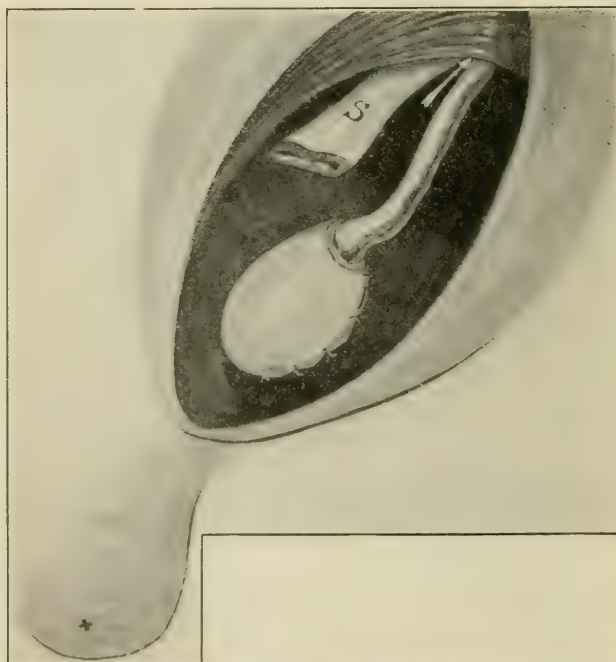


FIG. 13.—Step 2. Separation of vas and vessels in direction of arrow from non-ligated proximal portion of sac. X indicates position at lowermost portion of sac to which testis must be brought.

Dr. Eisendrath's conclusions are that "(1) cases of true non-descent or ectopic descent of the testis should be operated upon at as early an age as the condition of the child will permit, the lower limit being about two years. (2) Atrophy of the spermatogenic cells occurs in about 90 per cent. of the cases of retained testis, hence the necessity for early operation. (3) Tumor formation, torsion and the usual complications of the congenital hernia accompanying non-descent of the testis are not as rare as they are thought to be, and must be taken into consideration in weighing the question of an operation. (4) Hypopituitarism is not the result of the non-descent, but an independent and not infrequent accompanying condition. (5) The operation for non-descent,

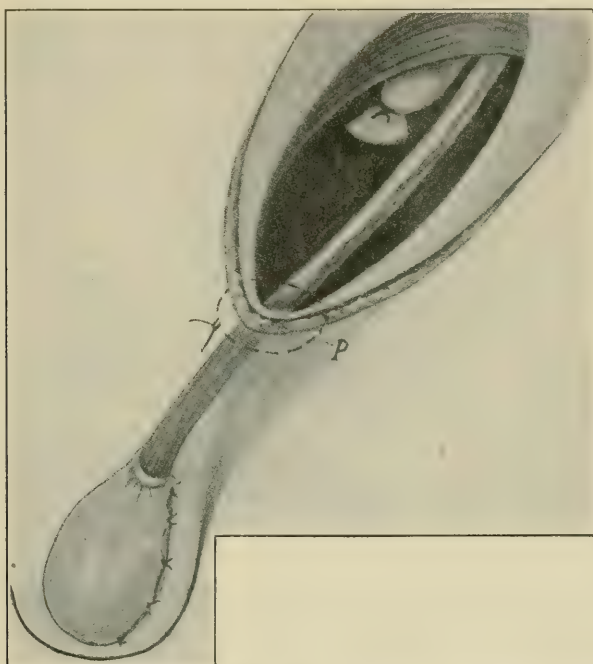


FIG. 14.—Step 3. Testis at lowermost portion of scrotum, prevented from slipping upward by purse-string at level of external ring. Proximal portion of sac ligated high up. Remainder of operation consists in usual repair of inguinal canal without transplantation of the cord.

i. e., retained testis, has but little influence upon the lack of development of the male sexual characteristics and one should be guarded in the prognosis for such cases, as well as in the possible development of the testis after operations in young adults."

Intersigmoid Retroperitoneal Hernia. J. C. Black,¹ of Regina, Saskatchewan, describes a case of intersigmoid retroperitoneal hernia. The patient was a woman, thirty-four years of age, with a history of a fall two years previously, when seven months pregnant. This was

¹ Surgery, Gynecology and Obstetrics, 1915, p. 527.

immediately followed by pain in the lumbar region of the spine and in the left iliac region. Constipation set in and inability to assume the left prone position or do much walking. Apparently, a coil of intestine entered the hernia while walking or lying on the left side, thus causing pain that would be temporarily relieved when turning on the right side. This pain continued throughout the remainder of pregnancy. Five days after childbirth, she was seized with violent pains radiating from the leg to the left iliac and lumbar region of the spine, associated with a good deal of edema of the left leg. A tentative diagnosis of psoas abscess was made at one time, but the symptoms disappeared, but the pain continued and there was tenderness at a point about midway between the left anterior superior spine and the umbilicus. These symptoms continued and she was operated upon six months later, in December, 1914. X-ray pictures gave no aid to the diagnosis. Black made the tentative diagnosis of a hernia into the sigmoid mesentery. At operation, a small hernia between the two peritoneal layers of the mesentery of the sigmoid was found. The hernia would admit two fingers and was about $1\frac{1}{2}$ to 2 inches deep, and was situated about 2 inches from the root of the right side of the mesentery. The peritoneum lining this cavity was dissected out and the opening closed with silk thread. The patient made a good recovery.

Black refers to a case of this type of hernia reported by Murphy, in *Clinics*, 1914, who stated that Moynihan claimed there were only 2 other cases reported in the entire medical literature.

One of these was a renowned case, already referred to in PROGRESSIVE MEDICINE.

Strangulated Epigastric Hernia. Gatewood,¹ of Chicago, reports a case of strangulated epigastric hernia in a man aged forty years. The patient had continuous severe pain in the upper abdomen since three days before admission to the Presbyterian Hospital. A small lump in the epigastrium had been present since childhood. He stated that this appeared immediately after an accident in which a wagon passed over him. The mass had remained practically unchanged during all these years, except that it had become very tender. The patient's temperature on admission was 99.2° and there was an acetone odor to his breath. The mass was fixed to the abdominal wall and very tender to the touch; it was the size of a lemon and situated midway between umbilicus and the xyphoid cartilage. The diagnosis of strangulated epigastric hernia was made, and an immediate operation performed by Dr. Bevan under novacaine infiltration anesthesia. The hernial sac was found protruding through an almost circular aperture in the linea alba, about 1 inch in diameter. On opening the sac, some dark brown fluid escaped; about 4 inches of small intestine, probably upper jejunum, in addition to some adherent omentum, were found within the sac. The bowel was brownish black, but improved markedly in color after the constricting ring had been enlarged by a lateral incision, so that it could be replaced. The patient made a good recovery.

¹ Journal of American Medical Association, March 27, 1915.

The author states that epigastric hernia is comparatively rare. According to Macready's statistics, it occurs in 1.19 per cent. of the cases; according to Berger, in 1.37 per cent. Coley, in his statistics of the Hospital for Ruptured and Crippled, covering 3,383 cases, reports 0.33 per cent. We have had 15 cases of epigastric hernia and no cases of strangulation. Our most recent statistics show 15 operations for non-strangulated epigastric hernia (no cases of strangulation in this series) in 5617 operations for all varieties of hernia. In the last 1000 hernia operations performed at the Presbyterian Hospital, of Chicago, there were 9 epigastric hernias, or 0.9 per cent.

Epigastric hernia usually begins as a small protrusion of fat through the transverse slit in the linea alba. Gatewood mentions four types; (1) Protrusion of a small mass of fat (described by Moschcowitz); (2) subperitoneal fat plus process of peritoneum, making a true sac, which, however, remains empty; (3) resembles the second type with the exception that the sac contains a bit of omentum; the 4th, and least common type, contains intestine as well as omentum.

Strangulation is extremely rare. In addition to the case above reported, Gateway has been able to find but 11 cases in the literature, and only 4 in which the sac contained omentum and intestine.

Guillaume,¹ of Wakefield, Scotland, reports a case of strangulated hernia of four days' duration in a child fifteen days old. The patient, although almost in a moribund condition on entering the hospital, recovered from the operation. Chloroform was used as the anesthetic. The fact that the strangulation existed for a long time without detection was probably due to the fact that the hernia was of the large bowel, which resisted gangrene much longer than the small intestine. The bowel was not gangrenous and was returned into the abdomen. The testicle had become gangrenous and had to be removed.

Murray,² of Liverpool, calls attention to certain *anomalies connected with the hernial sac*, particularly those associated with the formation of cysts. The different varieties of cysts referred to are best shown by the accompanying diagrams, figures 1 and 2 illustrating the findings in cases that occurred in his own practice. Fig. 1 shows a so-called "hydrocele of the cord" associated with an independent sac above. Fig. 2 represents the case of a scrotal hernia. The hernia had existed for many years and was irreducible. In addition to the sac, there was found at operation a large cyst, containing clear fluid, overlying and adherent to the anterior surface of the sac, although not communicating with it. Murray believes the origin of these two cysts can be best explained by the theory advanced by Mr. Lockwood regarding the etiology of infantile hernia, many years ago. Lockwood argued that if the processus vaginalis is drawn down by the gubernaculum, a second sac of peritoneum might be produced by the traction of some additional fibers of the gubernaculum, in very much the same way as the first. Imperfect obliteration of the vaginal process is usually responsible for the various cyst formations.

¹ Lancet, July 25, 1916.

² Annals of Surgery, May, 1916.

The term "hydrocele of the cord" is really a misnomer, as nearly all these cysts are collections of fluid in obliterated, or partially obliterated, hernial sacs.

In conclusion, Murray states that "as the gubernaculum is undoubtedly responsible for the presence of the peritoneal diverticulum known as the processus vaginalis testis, circumstantial evidence is strongly in favor of the view that if this process is found to be duplicated, then this second diverticulum must be due to a duplication of the force which produced the first. If this premise is correct, then the subsequent irregular obliteration of these processes clearly accounts for the anomalous conditions I have described."

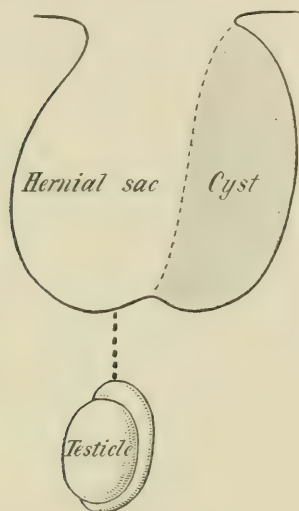


FIG. 15

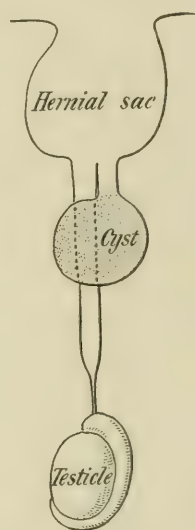


FIG. 16

Our own experience at the Hospital for Ruptured and Crippled confirms Murray's observations. We have seen all the types that he has mentioned, together with many others. He makes no reference to the cysts that are found in connection with the hernial sac in females. This condition, while rare, has nevertheless been frequently reported, and is usually designated as "hydrocele of the canal of Nuck." These cysts are really nothing more than accumulations of fluid in the obliterated, or partially obliterated, hernial sac in the female.

Inguinal Hernia. COMPLICATIONS AND SEQUELÆ OF THE OPERATION FOR INGUINAL HERNIA. The complications and sequelæ of the operation for inguinal hernia are emphasized by Lincoln Davis,¹ in an analysis of 1500 cases operated upon at the Massachusetts General Hospital. Davis quotes a number of other statistics in different countries and states that "the dissemination of such favorable modern statistics, together with improvements in general anesthesia, the intro-

¹ Journal of American Medical Association, August 12, 1916.

duction of spinal anesthesia, and wide adoption of local anesthesia, have greatly extended the field of this operation. An increasing number of the ruptured are insistently demanding surgical relief from the uncertainties and annoyances of truss treatment." He further states that "patients who a few years ago would have been rejected as unfit surgical risks on account of age, infirmity or intercurrent disease, are now readily accepted for this operation" and he raises the question as to whether the pendulum has not already swung too far in the direction of operation. The 1500 cases, which form the basis of Davis' study, were consecutive cases of inguinal hernia operated upon at the Massachusetts General Hospital from October, 1908, to December, 1914. Definitely strangulated hernias are not included. An important fact mentioned is, that these operations were performed by seventy-five individual operators—1093 operations were done by members of the visiting staff, the largest number by any one operator was 117, the smallest, one; 663 operations were done by 53 members of the junior staff. There was great variation as regards the age, physical and social condition of the patients. The youngest was ten months, the oldest seventy-seven years; 8 were over seventy years; 397 were between twenty and thirty years of age. There were 1388 males and 112 females. In 1244 cases one side was operated upon; in 256, both sides. In the 1500 cases, there was a total of 1756 operations, counting the double hernias as two operations. As regards the method of operation, Bassini's operation was done 834 times in the male, Ferguson's 764 times and Halsted's 15 times; in 24 instances the technic was varying.

In 16 cases in which the hernia was complicated by mal descended testicle, orchidectomy was performed. In 50 cases the undescended testicle was brought down into the scrotum; in 1 case it was put back into the abdominal cavity.

As to the anesthetic, general anesthesia was employed in 1319 cases; spinal anesthesia in 89 cases and local anesthesia in 75 cases.

Accidents and Complications. The bladder was injured in 2 cases, and sutured without ill effect. There were no cases of injury to the iliac vein in performing the radical operation. The vas deferens was cut 7 times. In 2 cases a small nick was made in the bowel; this was immediately sutured without bad effects. The mortality reported is 0.53 per cent. In 2 of the fatal cases death was due to complicating conditions. In 1 case, a feeble man of sixty-nine, with double hernia, gradually grew weaker and died of comatosis on the tenth day. In another case of double hernia, a large hematoma developed which was subsequently drained. A secondary operation was performed on the eighth day on account of abdominal pain, distention, and vomiting, with high fever. Perforated ulcers of the colon were found with general peritonitis. Autopsy showed no direct connection between the hernia operation and the peritonitis.

Complications that did not prove fatal were noted in 438 cases, or 28 per cent.; the most important of these was sepsis. Among these, 158 had failed to heal by first intention. In 93 cases the sepsis was very slight, consisting only in a stitch abscess or a small collection of serum

which required draining. Cultures were not made. In 65 cases there was frank pus in the wound, less than 4 per cent. of the total number of wounds.

Of the 75 cases in which operation was performed under local anesthesia, sepsis developed in the wounds in 13 cases, or 17 per cent.

Of the 89 cases in which spinal anesthesia was employed, there were 9 septic wounds, or 10 per cent.

This shows a much higher percentage of sepsis under local and spinal anesthesia, than under general anesthesia. This, we do not believe, has been the rule in other hospitals or with other surgeons. The percentage of wound infection, I think, is much higher than is found in statistics based upon the experience of a single operator. The operation for inguinal hernia, while ordinarily regarded as a simple operation which most house surgeons can do well, is in reality anything but a simple operation, and requires long experience before a technic approaching the ideal has been acquired. If Davis had gone a little further into details in his statistics, and given the results of the different operators, we believe that the complications, particularly as regards sepsis, would have shown a gradually diminishing percentage according to the number of cases performed by the different operators.

Complications in the Respiratory Tract. One hundred and thirty-eight, or no less than 9.2 per cent. showed respiratory complications as follows: Frank pneumonia, 7 cases; bronchitis in 48 cases; post-operative cough with slight temperature in 43 cases; pulmonary infarct, 2; tonsillitis, 30.

One would naturally infer that these complications offered a very strong reason for substituting local for general anesthesia in hernia operations. Yet Davis states that respiratory complications were by no means abolished by the use of spinal or local anesthesia, although he admits that these forms of anesthesia were probably selected on account of a bronchitis or cough on the part of the patient, before operation. Whatever may be the explanation, the fact remains that in the 170 cases operated upon under spinal or local anesthesia, respiratory complications occurred in 25, or 15 per cent. Other complications mentioned are: Otitis media, 2; measles, 1; cholangitis, 1; persistent hiccup, 3; acidosis, 2; phlebitis, 3; ataxic paraplegia, 1. There were 3 cases with mental symptoms; 1 with delirium; 2 with hallucinations and attempted suicide. In both latter cases spinal anesthesia had been used.

Dr. G. W. Quillian, in the *Annals of Surgery* for April, 1916, p. 385, publishes an article upon *acidosis in surgery*, and reports a fatal case occurring in conjunction with an operation for simple inguinal hernia in a girl. He emphasizes the dangers that may arise from acidosis, and the best means of avoiding them. Acidosis following operation has been associated with too great care in the preparation of the patient, together with too great caution in giving food after an anesthetic—the same reason that obtains in the starvation treatment of diabetes, when the carbohydrates have been withdrawn, and the fats are turning to fatty acids, resulting in diacetic acid. Personally, I believe that

it is better to give a patient contemplating a hernia operation the usual diet up to the afternoon before the operation. Unless the operation is a complicated one, it should not require more than ten to fifteen minutes; and the patient should be able to take light food within 12 hours.

There is a growing tendency on the part of surgeons to substitute local anesthesia, preferably novocaine, for ether anesthesia.

I see no reason why there should be any greater percentage of wound infection from local anesthesia than from general narcosis. Personally, I have never had a case of suppuration following local anesthesia, which corresponds to the observation of Bodine who has had a very large experience with local anesthesia. Primary wound healing has been almost universally observed.

After acidosis has once developed, the immediate administration of glucose, in addition to bicarbonate of soda, is recommended.

End-results. The end-results of Davis's series are particularly interesting, for the reason that late data were obtained in 754 cases; 140 patients reported by letter, and 614 were examined. Eight patients died in the hospital, after operation; 11 died of intercurrent disease within the year following operation; 577 are reported entirely well, or cured, 38 per cent. of the total number operated on, or 76 per cent. of those traced. Ninety-nine patients were classed as relieved; 50 of these were cured of the hernia but complained of subjective symptoms more or less closely associated with the wound. The most common complaint was that of pain in the wound, especially when lifting or working. Two complained of persistent numbness in the inguinal region. Seventeen of the patients, while relieved of the hernia, showed a bulging in the line of the scar; 8 had marked varicocele; 5 others, who were cured of the hernia operated upon, developed a hernia elsewhere; 3 had atrophy of the testis; 2 had keloid in the scar; 1 had a persistent sinus. Fifty-nine patients had a definite recurrence within the year; 5 of these had a double recurrence; 2 are known to have recurred after the lapse of a year, making a total of 66 recurrences, or 3.7 per cent. of the total number of operations performed, and 8 per cent. of the number of cases traced. Counting 6 cases of doubtful recurrence, the percentage is raised to 9 per cent. of the cases traced.

It is interesting to compare the number of recurrences following the Bassini operation and those observed after the Ferguson operation in which the cord is not transplanted. The results show very little difference. In the 834 Bassini operations, the percentage of recurrences was 3.1, while in the 764 Ferguson operations, it was 4.4 per cent.

This corresponds to our own results in children at the Hospital for Ruptured and Crippled, the percentage of recurrences being slightly less in the cases in which the cord was transplanted.

In the 112 female cases, there were only 2 recurrences.

These results correspond to our own observation, that inguinal hernia in the female shows the best result of any type of hernia operated upon.

In 88 cases of direct hernia, there were 7 recurrences, or 7.9 per cent., or 15 per cent. of the cases of direct hernia traced.

Of 75 cases in which local anesthesia was used, only 2 had a recur-

rence, or 2.5 per cent. This may be partly explained by the fact that local anesthesia was used only in the small hernias.

Simmons states that in his study of hernia he found that recurrence practically always takes place within six months after operation. This is in harmony with the statistics published by Dr. Bull and myself nearly twenty years ago.

Davis's conclusions are, that "the results of operation are, on the whole, good, better than might be expected under the conditions. The operation, however, has a definite, though low, mortality rate, and should not be undertaken in the old and infirm without good reason.

Postoperative cough, hematoma and sepsis are important factors in the incidence of recurrence, but the latter complications seem to play a less important rôle than is generally assigned to it.

A strikingly large number of patients anatomically cured complain of pain, probably due to nerve traumatism.

General anesthesia is still best in the routine case. Local anesthesia is very satisfactory, and has a wide application in cases in which inhalation anesthesia is contra-indicated, but carries a slightly greater risk of sepsis, and hence probably of recurrence, too, although the latter conclusion is not borne out by our figures. Spinal anesthesia, on account of its greater danger and serious sequelæ, should have little place in this operation.

Careful study in this series of cases reaffirms the importance of the well-recognized surgical principles of clean anatomical dissection, conservation of nerve supply, high closure of the sac, securing accurate coaptation of tissues without constriction, and complete hemostasis, in the attainment of success in the operation for inguinal hernia." Most operators fail to recognize the importance of not injuring the ilio-inguinal or iliohypogastric nerves, and of not including these in the deep sutures.

These statistics we regard as extremely valuable in showing the results that can reasonably be expected in a large general hospital.

Results of Operation for the Radical Cure of Hernia at the Hospital for Ruptured and Crippled, New York, from December, 1891, to January, 1917. During this period there have been performed at the hospital mentioned, 5617 operations. Of these, 4087 were indirect inguinal hernias in the male, with 25 recurrences or 0.6 per cent.; 24 were direct with no recurrences; 1002 operations were performed for inguinal hernia in the female, that is, 647 in children, with 1 recurrence, or 0.15 per cent., and 344 in adults with 13 or 3.7 per cent.; of this type, 11 were direct hernias with 1 recurrence or 9 per cent. Of the femoral hernias, 64 operations were performed in children, with no recurrence, and 173 in adults with 8 recurrences or 4.6 per cent. (It must be noted that 4 of these 8 were operated upon for a recurrence after a previous operation.) One hundred and fifty-seven operations were performed for umbilical hernia, of which 54 were in children, with no recurrence, and 103 in adults, with 3 recurrences, or 2.9 per cent. Ninety-four operations were done for ventral hernia: of these, 21 were in children without any recurrence, and 73 in adults with 12 recurrences, or 16.4 per cent. Fifteen

were for epigastric hernia with 1 relapse (6.6 per cent.) due to whooping-cough which developed immediately after the operation and was probably responsible for the recurrence. One operation was performed for lumbar hernia, without a recurrence.

With regard to the methods of operation, in 3334 cases of inguinal hernia in the male, the typical Bassini operation was performed with 14 recurrences or 0.41 per cent., and in 753 cases the modified Bassini was used in which the cord is not transplanted (11 recurrences—1.44 per cent.). This operation, usually known as the Ferguson operation, was first used at the Hospital for Ruptured and Crippled and was described by Bull and Coley.

Of the umbilical, 31 were operated upon by the older method, with 2 recurrences, or 6.4 per cent., and in 72 the Mayo operation (overlapping) was used, with 1 recurrence, or 1.3 per cent. Seventy-six operations for superficial inguinal and interstitial were done with no recurrence.

Three hundred and six operations were performed for undescended testes associated with hernia, without recurrence. In all of these cases the cord was not transplanted in order to permit the testis to be brought to a lower position in the scrotum. Thirty-seven operations were performed for strangulated hernia, with 2 recurrences, or 5.4 per cent. In the entire series there were 12 deaths, or 0.21 per cent.

RELAPSES.

OBLIQUE INGUINAL HERNIA IN THE MALE, 4087 CASES.

Relapses in the first six months	12
Relapse at the end of eleven months	1
“ “ “ one year	1
“ “ “ two years	3
“ “ “ three years	2
“ “ “ three and a half years	1
“ “ “ five years	1
“ “ “ seven years	1
“ “ “ fourteen years	1
“ “ “ twenty years	1
	<hr/>
	24

INGUINAL HERNIA IN THE FEMALE, 1002 CASES (647 IN CHILDREN; 344 IN ADULTS).

Relapse at the end of eleven days	1
Relapses in the first six months	5
“ “ “ year	5
“ at the end of one and a third years	1
“ “ “ four years	1
“ “ “ five years	1
	<hr/>
	14

In the above series (344—inguinal in the adult female), 13 relapses seems like a large percentage in a type of hernia which is regarded as most easily cured by operation. However, these statistics when analyzed show that one case had been operated upon for recurrence, one was a very large strangulated properitoneal hernia, another was in a seven-months' pregnant woman with an acute strangulated hernia (in this case, while

the patient made a good recovery, the wound suppurated, and labor coming a few months later caused a recurrence of the hernia); and another case was pregnant at the time of operation. The only relapse in 647 cases of inguinal hernia in female children was fatal, due to the fact that at the time of the first operation the sac was overlooked.

FEMORAL HERNIA, 237 CASES.

Relapse took place immediately after the operation	1
Relapse at the end of three months	1
“ “ “ five months	1
“ “ “ one year	2
“ “ “ two and a half years	1
“ “ “ nine years	1
Relapse—interval not stated	1
	<hr/> 8

UMBILICAL HERNIA, 157 CASES.

Relapse at the end of six months	1
“ “ “ one year	1
“ “ “ two and a half years	1
	<hr/> 3

VENTRAL HERNIA, 94 CASES.

Relapses at the end of six months	4
“ “ “ seven months	2
Relapse at the end of nine months	1
“ “ “ eleven months	1
“ “ “ one year	1
“ “ “ one and a third years	1
“ “ “ two years	1
“ “ “ three years	1
	<hr/> 12

EPIGASTRIC HERNIA, 15 CASES.

Relapse at the end of sixteen months	1
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INTERSTITIAL (SUPERFICIAL INGUINAL ASSOCIATED WITH UNDESCENDED TESTIS).

Relapse at the end of seven months	1
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SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA.

By JOHN C. A. GERSTER, M.D.

Gunshot Wounds of the Abdomen in War. During the past year, the fighting lines have remained practically immobile along the western front. The surgeons of both the Allies and the Central Powers have established operating rooms suitably fitted up for performing laparotomies close to the firing lines—in many instances such field stations are underground. Of necessity, it will be seen that they must be small. Larger hospitals have been located much closer to the lines than formerly, and this, plus improved facilities for rapid transportation, have made it possible to get the wounded, especially those with abdominal conditions, to well-equipped operating rooms in from three to twelve hours after injury. As might be expected, the laparotomy findings and the conclusions drawn by operators of both sides are very much the same, as the reader will see on looking through some brief abstracts from the French, English, and German literature given below.

The two most important innovations which have come to notice during the past year are: (1) the employment of the Carrel-Dakin method for the control of localized intra-abdominal suppurative processes, and (2) the autotransfusion of the patient's own blood in extensive intra-abdominal or intrapleural hemorrhages, provided there is no gross contamination of the blood, as in perforation of the alimentary tract.

From personal communications, the reviewer has gained the impression that the Carrel-Dakin method is all that its authors claim, and that, if a surgeon fails to get consistently good results, the fault lies not with the method but with the man who is trying to carry it out. It might be well to emphasize that the solution should be made up by a trained chemist who is able to assure the surgeon that the solution is neutral and contains between 45 per cent. and 50 per cent. of free chlorine—the average druggist is not equipped with the means for accurate titration for free chlorine and for acidity and alkalinity—and that the same strict asepsis must be maintained during each dressing (after the bacterial count is low) that one is accustomed to observe in performing a clean operation; if this is not done, the granulating surfaces become inadvertently infected and the bacterial count rises again. The details of covering the skin with yellow vaseline, of arranging the tubes and glass manifolds, etc., are so well known in American literature that they need no more than mention here. In the hospitals of New York, there have been a number of instances of successful secondary suture of

infected abdominal wounds following their sterilization by the Dakin solution. The technic of the method is not easily acquired, simple as it seems after reading the numerous descriptions.¹

The details of AUTOTRANSFUSION OF FLUID BLOOD PRESENT IN THE LARGE SEROUS CAVITIES IN CASES OF SEVERE HEMORRHAGE are as follows: Henschen,² of Sauerbruch's Clinic, suggests the possibility of gathering the blood found in either the thoracic or abdominal cavities under aseptic precautions and using the same for transfusion of the patient. Henschen also refers to the suggestion of Thies,³ made in 1914, to use the fluid blood found in the abdomen at operations for ectopic pregnancy, straining it through gauze, mixing it with physiological salt solution in proportions of 3 to 2, and then reinjecting it intravenously. Thies reported that he had saved the lives of 3 exsanguinated women by this procedure. They were pulseless at the time. In the first case this was done by subcutaneous introduction of the blood into the thigh, in the second and third, intravenously into the cubital vein and into a vein of the omentum. No ill-effects were observed.

Lichtenstein,⁴ from Zweifel's clinic, reports favorably on 7 cases of ruptured ectopic pregnancy and 1 case of rupture of a Cesarean scar. All those who had been transfused recovered. Chills were not observed, and in only 3 cases were there temporary rises in temperature. Lichtenstein defibrinates the blood and mixes it with Ringer's solution.

Henschen refers to the well-known fact that blood stays fluid in the thoracic and abdominal cavities for a long time. He then tells about the case of a young man with a laceration of the upper and lower lobes of the left lung upon whom a thoracotomy was performed one hour after being shot. There were one and a half liters of fluid blood in the left thoracic cavity. Only one thin clot was found on the diaphragm. The small wound of the left lung and the slit wound of the vein were sutured, and the thoracotomy wound was closed. The patient recovered. Henschen also speaks of the possibility of preventing coagulation of the blood after removal from the abdominal cavity and before its reinjection by adding sodium citrate according to Lewisohn's method. Kreuter⁵ was first able to apply this method to the exigencies of abdominal military surgery. In August, 1916, a young infantryman was brought to the field hospital three hours after being wounded with a shrapnel ball. The wound of entrance lay to the left of the eleventh thoracic vertebra; there was no wound of exit. There was extreme anemia, paresthesia, pains in both legs, hematuria, abdominal rigidity, and tenderness, which were most marked in the right hypochondrium. The diagnosis was made of gunshot wound of the liver with severe intraperitoneal hemorrhage, together with injury to the kidney and spinal cord. The abdominal cavity was found filled with blood, a large quantity of which escaped and was lost upon opening the peritoneum.

¹ H. H. M. Lyle: *Journal of American Medical Association*, January 13, 1917, p. 107; also W. O. Sherman, *Surgery, Gynecology and Obstetrics*, 1917, p. 255.

² *Zentralbl. f. Chir.*, 1916, p. 201.

⁴ *München. med. Wchnschr.*, 1915, No. 37.

³ *Zentralbl. f. Gynäk.*, 1914, No. 34.

⁵ *Ibid.*, 1916, p. 1498.

As much free blood as possible was gathered into the container of an ordinary saline infusion apparatus. It was strained through gauze. Meanwhile an arm vein was exposed and isolated. Within a very short time, a liter of blood was thus collected. The total intra-abdominal hemorrhage was estimated at between $2\frac{1}{2}$ and 3 liters. The bullet track passed from behind forward through the liver, and the bullet was found lying in the anterior abdominal wall. The wound of the liver was closed by deep through-and-through sutures; hemostasis was complete. The clots were removed from the abdomen and the peritoneal cavity was closed. While this was going on, an assistant infused the patient with the blood that had been gathered, as described above. Until the auto-infusion was started, at least twenty minutes elapsed; by this time the patient was moribund. About the time the infusion was ended, the suture of the abdominal wound was completed. The effect of this auto-transfusion was magical and totally unlike the usual effect of stimulants, such as strophanthin or the intravenous administration of saline, Locke's, or Ringer's solutions. Kreuter stated that the man, from an apparently moribund condition, recovered the use of his senses, was perfectly clear in his mind about locality, time, etc. However, the improvement was only transitory. The patient died of internal hemorrhage from the kidney three hours later. At autopsy, an enormous retroperitoneal hemorrhage was found.

It is noteworthy that the blood gathered from the peritoneal cavity remained fluid for fully half an hour after it had been outside of the body, without the addition of an anticoagulant, such as sodium citrate. Kreuter believes that lining vessels with paraffin is unnecessary. When only small quantities of blood can be obtained, they may be diluted to a certain extent with Ringer's solution or normal saline before being strained through gauze.

For those readers who are interested in the details of the subject, the following abstracts from the German, French, and English literature on gunshot wounds of the abdomen are appended:

GERMAN REPORTS. Fehling¹ reports the mortality of conservative treatment was estimated by the following authors to be:

Kraske	100 per cent.
Sauerbruch	94 "
Perthes	79 "
Körte	60 "

The operative mortality was:

Schmieden	66.0 "
Euderlen and Sauerbruch	55.6 "
Kraske	48.0 "

Consequently, all these men are in favor of early operative treatment whenever possible. Fehling wonders why more drainage is not instituted even in the so-called hopeless cases. At least a suprapubic stab wound with drainage of Douglas's pouch and perhaps a side opening in the

¹ Brun's Beiträge, Heft 3, xeviii, 351.

region of the anterosuperior spine might be made. Of 11 such hopeless cases, 2 were saved by this method. Fehling then claims that if such statistics are correct, among 1000 abdominal injuries 40 to 50 might be saved according to this method.

Wieting Pasha¹ frequently sees longitudinal gunshot wounds of the trunk passing through both thorax and abdomen as a result of the semi-prone position of the infantry in modern French warfare. If both thoracic and abdominal cavities are involved, the exploration of the abdomen should be begun first.

The Abdominal Wounds Caused by Hand Grenades give a much poorer prognosis than wounds made by other types of projectiles, both because of the extent of the local traumatism and because of the frequency of complications, such as tetanus and gas bacillus infection. According to Härtel,² injuries of the middle abdomen give a better prognosis than those of the hypochondrium or the pelvis. Härtel is an advocate of operative treatment of these wounds. Of 20 cases treated conservatively, only 1 recovered.

Free Gas in the Peritoneal Cavity invariably follows perforation of the gastro-intestinal tract, according to Kausch.³ When the diagnosis is in doubt, he makes a small median incision to determine the presence or absence of gas. In this connection the method of C. L. Gibson⁴ is of interest. He fills the small laparotomy wound with water just before knicking the peritoneum; thus even the smallest quantity of gas will be visibly demonstrable.

The Röntgen Diagnosis of Free Gas in the Peritoneal Cavity is readily demonstrable under the fluoroscope, according to Lenk.⁵ The gas was most frequently seen after wounds of the large intestine. With the patient in an upright position, the gas may be seen between the right lobe of the liver and the surface of the right diaphragm, in the form of a bright, semilunar strip. In distinguishing this collection of gas from a gas-containing subphrenic abscess, the latter will be seen to have a fluid level, constituting part, or all, of its lower outline. Such findings coincide with the experience of röntgenologists on the French and English sides.

ENGLISH REPORTS. Frazer and Bates⁶ are convinced that in the majority of cases of penetrating wounds of the abdomen, operative measures afford the best chance for success. They say that when the hollow viscera of the abdomen are wounded it is only the rarest exception that a spontaneous recovery occurs. When such cases arrive at the hospital, they are usually in a state of intense collapse. It is therefore customary to wait for one or two hours until this shock has subsided. (Of course, cases of rapid and progressive hemorrhage do not permit of such waiting.) Before operation, the patient is thoroughly warmed and 1 c.c. of pituitary extract is given. During operation, every precaution is taken to minimize the degree of shock. The operating room is thor-

¹ Deutsch. Ztschr. f. Chir., Band cxxiv, p. 553.

² Beitr. z. klin. Chir., 1916, Band c, Heft 3.

³ Berlin. klin. Wchnschr., 1915, No. 52.

⁴ Surgery, Gynecology and Obstetrics, April, 1916, p. 388.

⁵ München. med. Wchnschr., 1916, No. 35.

⁶ British Medical Journal, April 8, 1916, p. 509.

oughly warmed, the table is provided with a hot-water bed (rather dangerous procedure—REVIEWER), and Frazier and Bates have found it advantageous to employ the Trendelenburg position. Immediately before the operation is begun, the administration of subcutaneous saline is started and continued throughout the operation. Three or four pints of fluid are frequently given in this way. The abdomen is opened by a large incision and a rapid, but thorough, survey is systematically made of the viscera. In early cases with extensive soiling, irrigation has been practised, while in later cases with peritonitis this has not been done. Drainage of Douglas's pouch is universal, and at times it has been necessary to drain one or both flanks.

In their experience of 32 cases of penetrating wounds of the abdomen, Webb and Milligan,¹ state that measures taken to counteract shock will differentiate between moribund cases and those capable of reaction. It is useless to operate on any cases in deep shock. They consider the pulse the most dependable guide of all, a steadily rising pulse being a better indication for operation than any other symptom.

The patients brought in on the motor ambulance whose condition is doubtful, should be allowed to rest for a while, to see whether they will improve like others. Webb and Milligan make a systematic examination of the entire abdominal cavity before proceeding to repair any injury. Each intestinal wound as it is discovered is covered by a gauze sponge placed around the whole circumference of the gut and held in place by a clamp. Every effort is made to find the projectile, in cases in which it is retained, because of the bits of clothing it has carried in. Drainage tubes are inserted along the wound track. More cases were lost from shock after operation than from any other cause. Next came postoperative bronchopneumonia. Cellulitis of the abdominal wall was not an uncommon sequela.

Stevenson, Shaw, and Mackenzie² report 50 laparotomies at a casualty clearing station five and a half miles from the nearest line of trenches. Most of the men were operated on within five or six hours after being wounded. Some, however, did not reach the station until twelve or twenty-four hours had passed. They sterilize the skin with iodine except where large wounds are present in which case, after induction of anaesthesia, the operative field is prepared with lysol. They attempt to excise wounds of entrance and exit, using separate instruments from those employed in actual laparotomy. Speed in operation is a great desideratum. The abdomen is usually opened either at, or near, the middle line. Wounds in the intestine are repaired. Resection is employed for multiple injuries. Wounds of the liver and spleen are packed. When the kidney is badly lacerated, nephrectomy is indicated. When the wound is slight, the kidney may be left to heal without much danger. Some cases seem to benefit from a quantity of saline being left behind in the peritoneal cavity.

Stevenson, Shaw and Mackenzie have tried the introduction of ether into the peritoneal cavity in badly infected cases, but the shock produced

¹ British Journal of Surgery, 1916, vol. iv, p. 338.

² Lancet, July 29, 1916.

does not warrant continuance of this procedure, although it has given good results when the infection has been localized, as in appendicitis. During the operation, continuous saline is given subcutaneously by Lane's bag, and frequently an intravenous infusion is given in addition. Their results give a recovery rate of 34 per cent.

Wallace¹ reports that of 511 abdominal cases, 145 were hopeless. In 56 of the remaining 366, no operation was considered advisable. Of this latter number, 15 were probably wounds of the liver. These furnished most cases of undoubted penetration, which it was advisable to leave alone. The kidney furnished a few in addition. A chart of hundreds of abdominal injuries showed that two-thirds of the projectiles entered anterior to the lateral line of the body when viewed from the front and one-third behind this line. Therefore, on the whole, the posterior wound is the more dangerous. An anteroposterior wound in the upper part of the abdomen is the least dangerous, and a side-to-side wound lower down the most dangerous, although there is little to choose between the latter and the anteroposterior hypogastric buttock or hip wound.

In a large series of cases which were too bad for operation, with a wound of entry represented by a dot and wounds of entrance and exit connected by lines, the chart showed a dark, fan-shaped area, the apex of which was at the left costal margin. The chart indicated that the most dangerous wound is one of the left lower hypochondrium or upper lumbar region. A chart of the wounds of entrance showed a tendency for dots to collect toward the sides of the body. This is probably connected with the presence of the great vessels in the midline (and the immediate death from hemorrhage following their injury—REVIEWER). The small gut injuries were found serious from their multiplicity, the large gut injuries from their infectivity. Wounds of the small intestine showed a mortality of 63 per cent., the large intestine 60 per cent., the stomach 43 per cent., and the total hollow viscera mortality of 64 per cent. This latter figure indicates the increased danger from multiple injuries.

According to Crisp English,² wounds of the back, buttocks, and side which implicate the abdomen are often associated with multiple injuries of the intestines. The abdominal injuries in these cases may be overlooked in the first instance. Consequently, patients with wounds of the back, buttocks, and side should be admitted into the section reserved for abdominal cases where recognition of any possible abdominal injury can readily be made and the condition then promptly attended to. Spontaneous recovery from an intestinal perforation is rare, if it ever occurs, according to English, who says, "We saw and carefully examined a large number of intestinal injuries in all stages and found not a particle of evidence to suggest that these lesions ever heal spontaneously."

Expectant Treatment. "The arguments in favor of expectant treatment for most cases break down when one goes into detail and gets at the plain facts. It is pointed out that patients recover without operations, but we know now that these patients form a very small minority."

¹ Practitioner, September, 1916, p. 201.

² Lancet, October 28, 1916, p. 746.

In short, these represent abdominal injuries without perforation of the alimentary tract. In the first six months of 1915, the mortality for penetrating abdominal wounds was 73 per cent. For the last six months of 1915, it has been reduced to 61 per cent. Operation is never advisable if the pulse-rate is over 140. With those having a pulse-rate of 130, or over, it is better to keep them in the place where they are receiving their primary treatment until improvement occurs. No operation should last over forty-five minutes.

GUNSHOT WOUNDS OF THE SOLID ABDOMINAL VISCERA. Sir George H. Makins¹ speaks of the importance of secondary hemorrhage in infected wounds of the liver. Regarding biliary peritonitis, he says, "It appears doubtful whether fatal infection can follow the effusion of normal bile into the peritoneal cavity; more probably the peritonitis is caused by concurrent septic infection." In 3 cases of his own in civil practice, although the escape of bile led to considerable effusion of peritoneal fluid with biliary ascites, no marked inflammatory symptoms developed. The evidence furnished by the 6 cases in which bile entered the pleura also seemed to favor the view that, apart from extraneous infection, the presence of bile does not excite inflammatory reaction in serous cavities. Of the 25 patients dying from wounds of the liver, 60 per cent. died of some form of septic infection and 40 per cent. from secondary hemorrhage. As to treatment, the planning of a fresh incision to allow direct access to the retained missile is not to be recommended because of the possibility of opening up fresh paths of infection. Try to extract the missile by following its original path through the organ, perhaps enlarging the same. In 4 patients dying with injury to the spleen, in none was the splenic injury the direct cause of death, associated injuries being responsible for the fatal outcome.

In wounds of the kidney, hematuria was frequently absent. Secondary hemorrhage was present in 12 of the 26 cases, occurring any time from the sixth to the twenty-third day.

The most common cause of death from gunshot wounds of the kidney was secondary hemorrhage. Infection was invariably present. As to prognosis: Uncomplicated wounds of the kidney, either by bullet or fragments of shells, cannot be regarded as serious injuries apart from the danger of secondary hemorrhage. Nephrectomy is the best procedure for the control of this complication.

No patient should be allowed to leave the table after nephrectomy for secondary hemorrhage from the kidney without the surgeon assuring himself that there is no blood-clot in the bladder and that the bladder is empty.

Romanis² reports the case of an Australian soldier wounded by a high explosive shell, the fragment entering just below the left costal margin. At laparotomy, the track of the fragment was traced downward, and to the right, through the left lobe of the liver, emerging on its under surface, and passing through the lesser omentum, tearing a lateral hole half an inch long in the portal vein, from which blood was found gushing freely.

¹ British Journal of Surgery, April, 1916, p. 645.

² Lancet, October 14, 1916, p. 679.

A tampon was placed in the liver wound and two artery forceps were clamped on the side of the vein in a longitudinal direction, thus controlling the hemorrhage. There was no perforation of the gastro-intestinal tract. The tampon to the liver and the two artery forceps clamping the lateral wound in the portal vein were left *in situ*, with the handles emerging from the upper end of the abdominal incision. The patient died of a secondary hemorrhage from a lateral wound of the renal artery on the eighth day. At autopsy, there was no peritonitis, the lumen of the portal vein was patent, the wound in it being represented by a sound scar (the artery forceps had been taken off on the third day without difficulty).

FRENCH REPORTS. Quenu¹ refuses to admit that soldiers with abdominal wounds should be abandoned to their fate because of insufficiency of means of treatment. During the period of actual battle the means for performing laparotomies should be increased and should be put up where most of the wounded congregate. Professors Delbet, Rochard, Monprofit and Broca were of the same opinion, and the latter moved a resolution for a public pronouncement on the part of the Société de Chirurgie in favor of early intervention in abdominal wounds. This resolution was unanimously passed. In order to make this more effective, a further resolution was passed that automobile ambulances should be concentrated at the point where the most wounded were assembled, according to need and for the time necessary, so as to provide rapid transportation for those in whom early intervention was a factor in recovery.

Fauntleroy² says, "The results from operative treatment have been most encouraging in improving the statistics as compared with the expectant line of treatment." . . . As nearly all shrapnel, shell, and bomb wounds are septic and produce great visceral injury, operation will give a better chance of success than expectant treatment if the patient is in a fit condition to bear it and the case is seen early. In cases seen late, when peritonitis is already established, the pelvis is drained through a suprapubic stab wound and the Fowler position is maintained."

Fauntleroy quotes a letter from Joseph A. Blake who says: "I have seen remarkably good work in the first dressing stations in the English army situated even in front of the big guns. In one ward of twenty beds established in a laundry, I saw 8 cases of intestinal resection, performed for wounds of the intestine, getting well, and I firmly believe in an early intervention."

Rouvilloin,³ and his associates, report a series of 247 abdominal wounds. They divided these into extraperitoneal wounds, peritoneal wounds, and thoraco-abdominal wounds. In non-operative cases, the mortality was 100 per cent. Regarding operations (laparotomy), the following experiences are of interest. Simple peritoneal wounds gave no mortality. Visceroperitoneal wounds, a mortality of 80 per cent. Single wounds (univisceral) gave a mortality of 75 per cent. Multiple injuries of the

¹ Journal of American Medical Association, vol. lxvi, p. 2000, Paris letter.

² Annals of Surgery, August, 1916, p. 146.

³ Bull. et mém. Soc. de Chir de Paris, 1916, vol. xlii, p. 708.

viscera gave a mortality of 90 per cent. Rouvilloin and his co-workers consider that the surgical indications for the treatment of abdominal wounds—gunshot wounds—are the same in war as in peace. They advocate the establishment of operating rooms twelve kilometers back of the firing line. All cases should be operated upon provided their general condition permits.

According to Schwartz and Mocquot,¹ two varieties of arguments are advanced against operative treatment of gunshot wounds of the abdomen. The scientific arguments against this are: The tendency of such wounds to spontaneous recovery, the baneful influence of shock, and the bad results given by operation. In replying to this, the authors state that spontaneous recovery of abdominal wounds with intestinal perforation is extremely rare, that except at laparotomy it is impossible to state whether a perforation exists or not. In other words, that many cases with supposed perforations (as, for example, when the projectile has entered through the chest), really do not have them. Again, the fact that occasionally the perforating wounds of the intestine recover spontaneously (as in the side regions of the abdomen even when the large intestine is involved), is not an argument against operation. Of 60 laparotomies done by these authors, 19 recovered. In the men who died, the lesions were beyond help. In those who recovered, the intra-abdominal findings were such that death would certainly have occurred had not an operation been performed.

The military arguments against operation were: Delay in arrival of the wounded, difficulty of maintaining aseptic conditions, the length of time required for operation, and the difficulty of handling hundreds of wounded arriving simultaneously. The first two criticisms can be easily disposed of by proper organization and equipment. As regards the time required for operations, the authors state that no more time is required for laparotomy than for treating an extensive injury of the limb. The most convincing of the arguments in favor of laparotomy is that if it saves a man, he is usually restored to complete health and is not left a cripple.

In this letter² there is an account of Chevassu, who was in charge of a special automobile ambulance (surgical). He reports 210 cases of abdominal wounds which were observed within a period of fifteen days. Originally, he was a believer in operation. Necessity compelled him to practise abstention and to save limbs and so refrain from abdominal operations, because of the length of time each required. Examining the cases of abdominal wounds some days afterward, he was pleased to find unexpectedly good results. Chevassu says that he considered only intraperitoneal wounds. Of 136, out of these 210 cases, there were 57 dead and 79 discharged, with a death-rate of 41 per cent.

Tuffier, who was commissioned to make a report on the work of Chevassu, did not declare himself convinced, for out of 32 cases of wounds supposed to involve the small intestine, he regarded only 16 as absolutely

¹ *Revue de Chir.*, 1916, p. 56.

² Paris letter of April 6, 1916, to *Journal of American Medical Association*, May 6, 1916, p. 1477.

certain. This is half of the whole number, and this half includes the 6 deaths, making a mortality of 37 per cent., and 62 per cent. of recoveries. This is a high percentage of recoveries, but in Tuffier's opinion it is not sufficient to decide the question between operation and non-operative treatment. In short, when possible and when the patients condition is sufficiently good to justify it, operation is the treatment of choice.

Extraperitoneal Wounds of the Colon. Stassen and Voncken¹ insist that extraperitoneal wounds of the colon should not be included in the statistics of other abdominal wounds; their only danger is from a sub-peritoneal phlegmon.

They also state that the disappearance of liver dulness, formerly regarded as an infallible sign of perforation of the intestine, has lost its diagnostic value, since it may occur with these extraperitoneal wounds of the colon. The same might be said of all other classic "abdominal signs." Only intensity of the symptoms, the relation between them and the clinical aspect as a whole, in connection with the pulse-rate and quality, enable one to distinguish between the harmless cases and those requiring laparotomy.

The Element of Error in Abdominal Diagnosis is the subject of a most illuminating paper by Foss,² of the Mayo Clinic, who studied 1170 patients. About half of these came to operation. With the latter group it was found there was a gross error of 10 per cent. in the primary diagnosis. In all of these, the surgical indications were correct and the operation was justified, but the clinical diagnosis was wrong. Of these, 31 cases (75 per cent.) were associated with the duodenum, gall-bladder, or appendix. The list of known errors would have been much smaller had not an ample rectus incision been made, which permitted adequate exploration of the entire abdomen. That is, operations would have been completed without knowledge of pathological conditions elsewhere in the abdomen than directly over the right iliac fossa. Foss says such an operation leaves the surgeon in but a slightly better position than the gastro-enterologist, "who cures gastric and duodenal ulcers, and is only kept from knowing that he hasn't by the thickness of the abdominal wall."

Foss points out the striking similarity in the symptoms of chronic appendicitis and of duodenal ulcer. He had several instances in which a 90 per cent. diagnosis of duodenal ulcer was made because of a clear so-called text-book history, in which, at operation, the patients were relieved by the removal of their appendices. In 27 per cent. of gastric ulcer cases, the primary diagnosis was duodenal ulcer. Among 14 cases of duodenal ulcer, there was an error in the primary diagnosis in 36 per cent. In short, Foss says that we are sorely in need of more accurate methods of procedure in surgical diagnosis, particularly as applied to the upper abdomen. The clinical history stands first in value, but this is frequently unreliable. The x-rays have proved of enormous value. Fluoroscopic examination combined with serial plate investigation has

¹ Presse Méd., November 18, 1916, p. 444.

² Annals of Surgery, July, 1916, p. 39.

increased efficiency of preoperative diagnosis, so that it was accurate in nearly 80 per cent. for duodenal ulcer, 90 per cent. for gastric ulcer, and over 95 per cent. for gastric cancer.

The commonest errors in abdominal diagnosis are made in connection with lesions in the gall-bladder, duodenum, and appendix; next are the mistakes made in rendering a preoperative diagnosis in diseases of the urinary system. Thus, "the large clinic does not exist in which, at some time or other, one of its surgeons has not come down upon a perfectly apparent cystic gall-bladder or splenic tumor only to regret he had not made a posterior incision through which to remove the hydronephrotic kidney brought to light."

The routine employment of the Wassermann reaction has shown that specific disease is more prevalent than was ordinarily supposed; 600, out of 4000 general hospital patients, gave a positive reaction. Moreover, the necessity for Wassermann tests of the spinal fluid was shown by the fact that but 18 per cent. of tabetics gave a positive Wassermann. Cases of unsuspected syphilis greatly outnumbered those frankly syphilitic. Nuzum's figures are referred to in which 8.7 per cent. of 1000 tabetics were subjected to laparotomy.

To increase the daily diagnostic efficiency and check up errors, it is customary at the Mayo Clinic for one clinician to come in after all evidence has been collected and go over the case in consultation. Thus, in 3 per cent. of the patients the consultant was able to elicit highly important facts from the histories which had been overlooked; in over 3 per cent., valuable details in physical examination were likewise noted by the consultant; and, finally, 4.1 per cent. of the final diagnosis as made by the original examiner, was checked up and corrected by the consultant. Hurried examination is avoided. Thus a patient with vague intra-abdominal symptoms will require at least one hour for his first examination. Working eight hours a day, Foss averaged between 7 and 9 cases. He says: "Let this number be increased to 12 or 14, and the diagnostic mistakes will immediately increase as a result of the necessitated haste."

As most dangerous, Foss points out the omission to recognize the indications for some special type of examination. A serum test, a fluoroscopic examination, a pyelogram, or a proctoscopy may be all that is necessary to clear up some hitherto obscure problem.

In spite of all the laboratory assistance, nevertheless the prime requisites for a successful diagnostician are the same today as they were before the Crookes tube, the microscope, or the guinea-pig were known to medicine, and also the ancient statement is truer than ever, that incorrect diagnoses are oftener made as the result of carelessness rather than from the lack of actual knowledge.

The Röntgen-ray Examination of the Digestive Tract in Babies and Children has opened up an entirely new field, according to Kerley and LeWald.¹ Intestinal disorders have been found to be caused by hitherto unsuspected factors, such as abnormal length or size of the entire intestinal canal or some one part of it, such as the sigmoid flexure. Reflex

¹ Journal of American Medical Association, vol. lxvii, p. 1569.

nervous conditions, convulsions, asthmatic attacks, food idiosyncrasies etc., may be proved to have their cause here and may be cured by appropriate medical or surgical measures based upon the Röntgen-ray disclosures. Kerley and LeWald state that the former ideas of anatomists and pediatricists to the effect that the rest of the colon grows at the expense of the sigmoid flexure is no longer tenable in view of the evidence accumulated by Röntgen-ray study of the living anatomy of individual children over a period of months and years. Once a long sigmoid, always a long sigmoid.

The recognition of varying degrees of pyloric stenosis in older infants or children is of the greatest aid in treatment. Whether some of these cases are of congenital origin, but not of the degree to demand surgical intervention in infancy, is a problem upon which the authors hope to throw light in the near future. Many of the gastro-intestinal disorders in children are due to mechanical factors which can be easily managed provided the cause is known. Kerley and Le Wald believe that many cases of ptosis of the stomach and intestines found in adults are of congenital origin, or have their origin during child life because of erroneous habits in eating. The child of five, six, or eight years eats a large meal three times a day, and then drinks the two or three glasses of milk which he is urged to take. All this means that two pounds of food or more are placed in the stomach, more weight than many can accommodate, and ptosis results.

Transverse Incisions in the Upper Abdomen are coming more and more into favor. A. V. Moschcowitz¹ points out that N. W. Green and others (see below) have devised improved methods in suturing so as to prevent retraction of the abdominal wall in operative wounds of the upper abdomen. In speaking of the anatomy and physiology of the abdominal parietes, Moschcowitz says: "The peculiar arrangement in the upper abdomen where the peritoneum, transversalis fascia, and posterior sheath of the rectus are inseparably welded together so that the several aponeuroses resemble a multitude of horizontal-running, little tendons, is of threefold importance: (1) an incision in a vertical direction will necessarily divide a large number of these tendon structures at right angles to all three muscles; (2) after such a division and whenever the muscles retract, there will be a tendency to pull the edges of the wound more and more apart; (3) a vertical direction materially increases the difficulties in closing the wound because the pull of the sutures is parallel with the tendon fibrillæ and hence also parallel with the direction of the pull. As a good example of this, Moschcowitz points out the relative difficulty in suturing the peritoneum and fascia in a Kammerer incision. Below the semilunar fold of Douglas this suture is very easy, whereas above the semilunar fold the suture becomes more difficult the higher the incision goes (Fig. 17). By transverse division of the rectus, Moschcowitz says that only one of the segments of the muscle is injured and that the nerve supplies of this segment and of the abdominal wall are practically uninjured. After healing has taken place, such a gap merely represents an additional linea transversa.

¹ *Annals of Surgery*, September, 1916, p. 268.

Moschcowitz points out with great justice that the nerves running through the rectus are exposed to injury by every vertical incision of the right upper quadrant of the abdomen. On the other hand the transverse incision runs parallel with the nerves and consequently the risk of injury is very remote. In previous reviews I have described the technic. Personally, the reviewer readily concedes the advantages of exposure through this incision, its ease of closure, and the satisfactory end-results, so far as cosmetic appearance and non-development of hernia go. There are only two disadvantages: One is the inability to gain a better exposure of the lower abdomen provided the incision is placed too high; and, second, the time required for the preliminary hemostatic mattress sutures anchoring the rectus to its anterior sheath. But these are not cardinal objections.

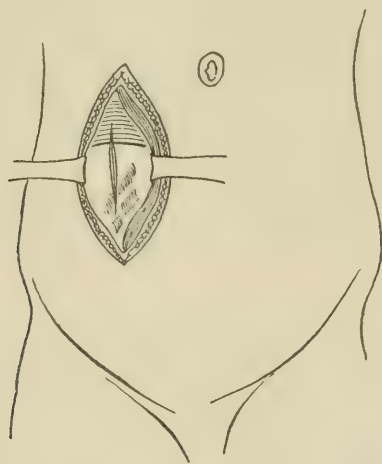


FIG. 17.—A Kammerer incision extending above the semilunar fold of Douglas.
(Moschcowitz.)

Moschcowitz's series comprises 97 cases, of which 67 were available for examination over a period of from a few months to almost six years. The only difference between the drained and undrained cases was that there was a slight retraction—not a bulging—at the site of drainage. In one case a vertical right rectus incision was followed at a subsequent operation by a transverse incision, and a hernia subsequently developed in the vertical part of the scar, whereas the transverse incision remained solidly healed.

Relaparotomy through the same incision has given satisfactory end-results after three years in one case. In another case, a man, aged forty-one years, was operated upon for ulcer of the stomach through a transverse incision. The postoperative course was stormy, and the patient vomited continuously. This put such a strain on the sutures of the abdominal wound that about four inches of it separated. This was resutured without an anesthetic. Ten days after operation there was persistent vomiting and other signs of intestinal obstruction which

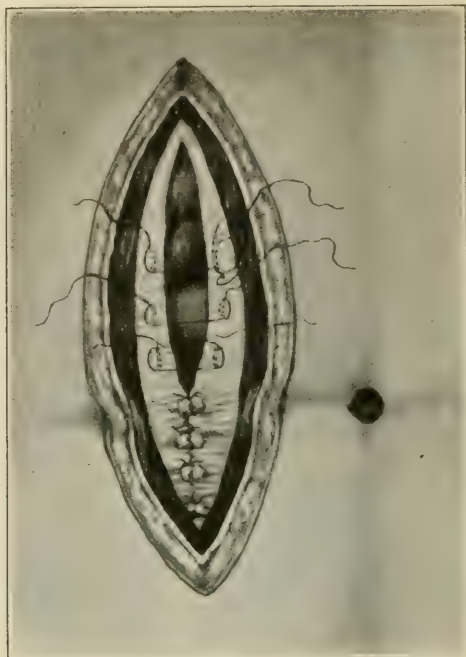


FIG. 18.—Interrupted stitch. (Green.)

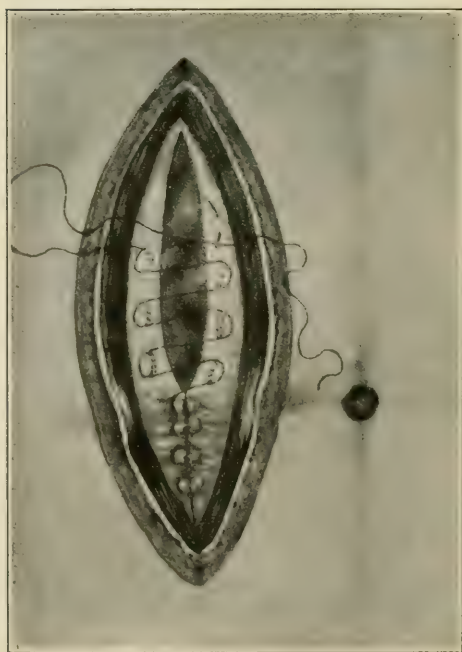


FIG. 19.—Continuous stitch. It shows the lower part of the wound drawn up tightly, and the upper few stitches placed loosely, ready to be "laced" up. (Green.)

necessitated a reopening of the abdomen. A band was found and divided, but the patient's condition was so bad that a hurried through-and-through suture of silk had to be made. The patient finally recovered. At examination, a year and a quarter later, there was no hernia to be seen.

Stitch for Closure of the Abdominal Wall. Closure of the customary right rectus incision in the upper abdomen is notoriously difficult in stout people. It is not uncommon to see the usual running stitch either pull out or slit the fascia in the direction of its fibers at each stitch hole. In some clinics, notably the Mayo Clinic, the sutures for closing the peritoneum not only perforate the peritoneal coat, but also the muscle and the fascia of the anterior sheath.

N. W. Green,¹ has devised a stitch embodying the same principle as that commonly employed in tendon suture, namely, an extra loop

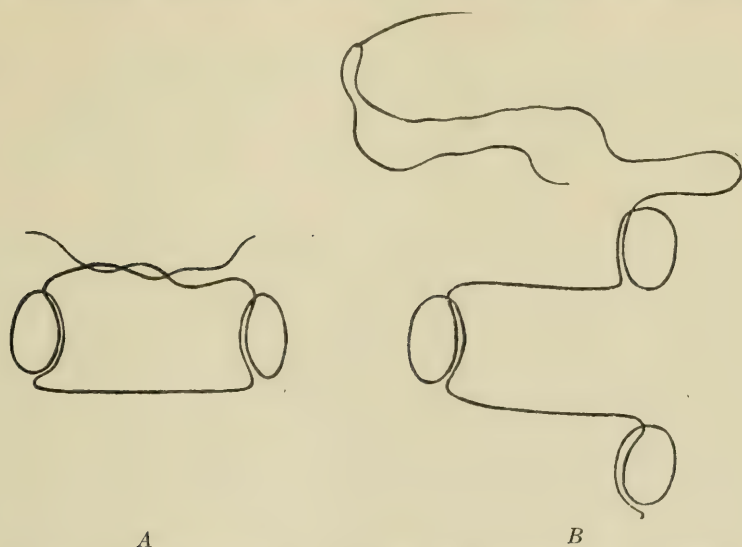


FIG. 20.—A, interrupted stitch; B, diagram of continuous stitch. (Green.)

around the fasciculus which tightens upon the material it surrounds, increasing the tightening effect with the increase in tension upon it. Figs. 18, 19 and 20, show this stitch and its possible variations, either as an interrupted or continuous stitch. The technic is as follows: The needle is put through the posterior layer of the internal oblique and the transversalis aponeurosis, transversalis fascia, and peritoneum with one stroke; then brought out with another stroke, including some fasciculi of this combined aponeurosis; then it is returned again through the first hole and brought out again through the second hole, so that we have a complete loop surrounding these fasciculi; it is then brought across to the other lip of the wound and put through in a similar manner, placing the first puncture opposite to the last puncture of the other side. The

¹ *Annals of Surgery*, March, 1916, p. 364.

ends are then tied with the ordinary first half of a square knot, and, as these are pulled up, the slack between the two loops is then drawn up easily. The tighter it is tied, the tighter will the loops around the fascia and peritoneum hold. The second half of the square knot completes the interrupted stitch. Plain catgut, chromic gut, or kangaroo tendon should be used, as it slips through the tissues readily when the stitches are drawn up. For the continuous stitch, the same procedure is done without tying between the stitches, and at the completion of each half of the stitch, the slack is pulled up.

Green quotes the suggestion of H. H. M. Lyle, to begin the stitch from the peritoneal side and finish it on that side so that the peritoneum is everted rather than inverted by it. This modification, Green thinks, is applicable when there is little tension, but, in the presence of great tension, he believes that the original way, namely, of inverting the peritoneum and approximating the fascia is the more feasible. Green reports the successful employment of this stitch in several cases.

Treatment of Peritonitis. In former years of various methods for establishing more or less continuous drainage of the stomach in postoperative dilatation of that organ have been spoken of.¹ It will be remembered that a gastrostomy was employed by certain German authors, and that Westermann, a Dutch surgeon, established permanent drainage by means of a stomach-tube passed either through the mouth or through the nose. Neither of these methods have proved popular. In the case of the stomach-tube, the patients were very uncomfortable and resented its permanent retention. Regarding the gastrostomy, surgeons have been somewhat cautious about operating for simple acute dilatation of the stomach. It remained for an American (Kanavel, of Chicago) to devise a method both effective for the surgeon and tolerable for the patient.

According to Kanavel² the duodenal tube and its carrier are constructed as follows: The bulb is the same size as the Rehfuß bulb, except that the lumen of exit is larger, and it is so constructed that it is impossible for the wire carrier to slip out. The rubber tubing is of the same size as the Rehfuß tube, but only thirty inches long, being attached to a second heavier tube twenty-five inches long by a screw lock. A carrier of piano wire is made to fit the first tube, so that it can be introduced without difficulty. The second tube is attached after the removal of the carrier, and the contents of the stomach aspirated or siphoned off (Figs. 21 and 22).

If the patient will swallow the tube, the lumen of exit of the bulb being larger than the Rehfuß tube, the stomach contents can be aspirated with greater freedom and the mucus interferes less. This latter is of considerable importance in postoperative lavage when the mucus is generally considerable and interferes even with this tube at times. It will be seen that the bulb is so constructed that the point of the wire carrier cannot slip out of the bulb and injure the stomach. Owing to the shortening of the rubber tubing, there is less probability of the collapse

¹ See *PROGRESSIVE MEDICINE*, June, 1915, p. 58; 1916, p. 69.

² *Surgery, Gynecology and Obstetrics*, October, 1916, p. 483.

of the tube upon suction and there is less difficulty in removing the carrier. This latter procedure is also aided by having the patient throw his head back, thus lessening the sharp angle in the tube.

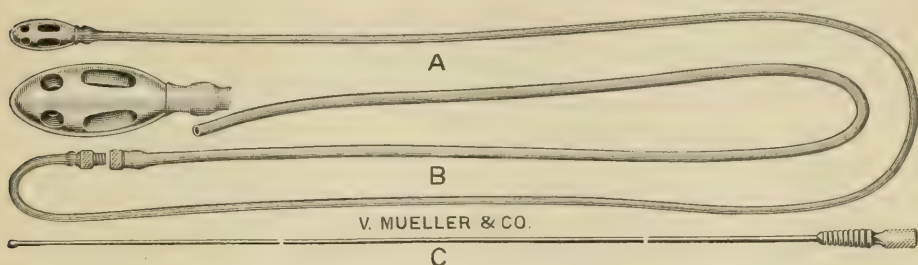


FIG. 21.—Stomach lavage tube, bulb, and wire carrier. (Kanavel.)

The tube described has proved of signal benefit in the vomiting of peritonitis or persistent vomiting from any cause, as well as being of great aid in the routine examination of stomach contents for diagnosis. In the former instance, the tube is either introduced by the surgeon or is swallowed by the patient. It is then attached to the chin by a piece

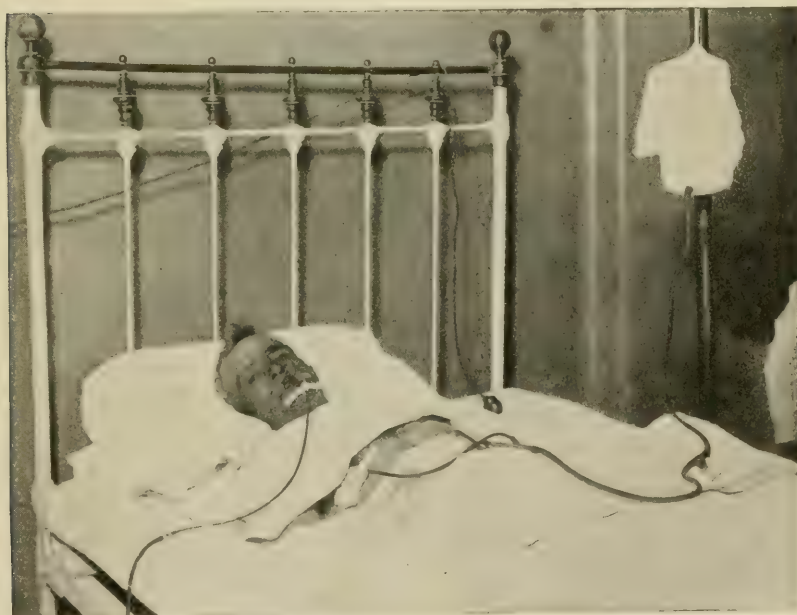


FIG. 22.—Patient with Kanavel's continuous stomach lavage and continuous hypodermoclysis applied.

of adhesive plaster, and may be left in for days. In the regurgitation incident to peritonitis, the stomach contents are aspirated every half-hour, and at regular intervals the stomach is washed out by injecting

soda solution, or other liquid, through the tube and aspirating it. Between the washings, the end of the rubber tube attached is placed in a basin with the end covered by fluid so that a continuous siphonage takes place. The retention of the tube is without discomfort, while the absence of stomach distention and vomiting gives the greatest relief.

Fluid may be left in the stomach or medication given, if desired. In one patient with peritonitis who was apparently moribund, the tube was kept in the stomach four days and the patient did not vomit after the treatment was begun, although he had been regurgitating large amounts previously. In addition to being used in peritonitis cases, it has been used in persistent vomiting from any cause, as paralytic ileus, gastritis, toxemic vomiting, etc. In such patients, after washing the stomach for a day or two, small amounts of liquid food are introduced, and if subsequent suction shows that the food is being absorbed, or is passing the pylorus, feeding is increased. Thus, without discomfort to the patient, we give food at the earliest possible moment.

If the tube passes the pylorus, as it may upon the resumption of the normal stomach peristalsis, the duodenal contents are then aspirated which may be of benefit in some cases. Kanavel suggests that it might be possible to carry the tube through a gastro-enterostomy opening at the time of operation and then aspirate intestinal contents or introduce food.

Continuous Hypodermoclysis. One of the disadvantages of hypodermoclysis has been the pain caused both by the insertion of the needle and later by stretching of the tissues with the solution. To lessen the patient's discomfort and to lessen the work of the surgeon (for the administration of hypodermoclysis at stated intervals takes considerable time) Kanavel has resorted to continuous hypodermoclysis. He uses the ordinary hypodermoclysis set (with the exception that the needles are much finer than those commonly supplied there is a Y-connection) so that two needles can be simultaneously used, but provision is made for shutting off the flow to each needle separately. The needle chosen is four inches in length and of a No. 20 size. Care is taken to cause no pain either during insertion of the needles or during administration of the solution. Thus, the skin is blistered with a few drops of novocaine, 0.5 per cent. solution, using the finest hypodermic needle. Then a few drops of the same solution are forced along the course we expect the needle to follow in the deeper tissues. The point of a fine, sharp hypodermoclysis needle is then placed against the skin and gently rotated with firm pressure. The penetration of the needle is without pain. Once it is in place, the head of the needle is wrapped in gauze so that it does not press against the skin and it is then fixed in position with adhesive plaster (Fig. 22). The solution is kept warm by frequently refilling the container, and it should be allowed to flow so slowly as to never distend the tissue sufficiently to cause pain. Whenever a sense of fulness is experienced by the patient, the flow to the needle on that side is shut off. Kanavel says that in this manner he has frequently given normal saline solution continuously for two or three days, with no discomfort or ill-consequences to the patient. It has been used in

children without the slightest complaint on their part and has become a routine in all cases of persistent vomiting in toxemia, such as peritonitis, ileus, pernicious vomiting of pregnancy, toxic nephritis, sepsis, etc.

In debilitated patients the needles have been inserted and hypodermoclysis has been begun at the beginning of an operation, and has been continued during the operation and afterward without disturbing the patient or stopping the administration of the saline. Naturally in those cases in which proctoclysis is contra-indicated, this hypodermoclysis is the method of choice.

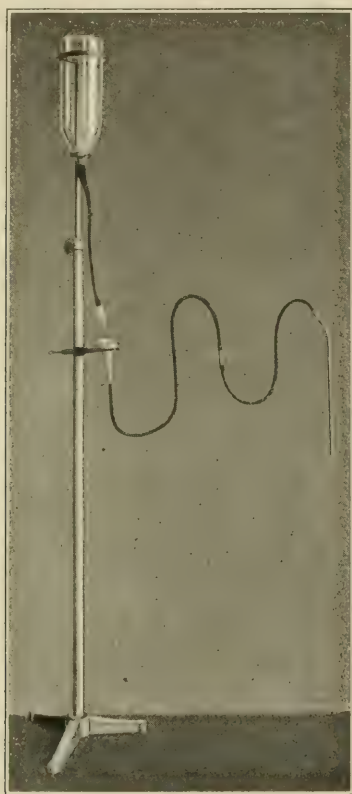


FIG. 23.—Apparatus for giving solutions by bowel. (Weeks.)

By his continuous hypodermoclysis, Kanavel has given as much as 4000 c.c. over a period of three days to a seven-year-old child with general peritonitis; 9000 c.c. in four days to a young man, and 13,000 c.c. in forty-four hours to still another patient. Kanavel has found that the benefit to patients suffering from peritonitis from the combined use of continuous gastric lavage and continuous hypodermoclysis is far beyond that secured by any other procedure of a similar nature.

Improved Proctoclysis Apparatus. Of the numerous MODIFICATIONS OF APPARATUS FOR ADMINISTRATION OF MURPHY'S PROCTOCLYSIS, the

one by Weeks,¹ of San Francisco, is noteworthy because of its simplicity. It consists of the usual container and dripper plus a small glass bottle, a funnel holder which will fit on the container stand, and the usual rubber tubing with glass tip and ordinary rubber catheter (Fig. 23). The funnel is to be placed on a level with the patient's abdomen. The container is so hung that the dripper shall drip into the funnel. Naturally, the catheter is not displaced except for the administration of enemata or some other similar reason. The advantage of the arrangement is, that it allows the gas to bubble out of the funnel at all times, and prevents the gas pains and distention so frequently observed after administration of the Murphy drip. Weeks has found this particularly useful after operations upon children.

Rectal Feeding. An excellent review of the subject of rectal feeding has recently appeared.² The most easily absorbed substances were certain inorganic salts, dextrose, and amino-acids. Dextrose is not only more readily absorbed than other sugars, but is also less irritant. It should rarely be given in stronger concentration than 10 per cent. Fats and oils should not be used. Alcohol and coffee are readily absorbed. The presence of fats and oil may hinder the absorption of other substances.

As to the use of proteins, Bywaters and Short believe that failure to receive benefit from protein material in nutrient enemata was due to careless or incomplete peptonization of the protein. When *peptonization is carried on for twenty-four hours with a very active pancreatic extract* greater amounts of amino-acids are produced. These are then absorbed, as shown by the increase of urinary nitrogen. Bywaters and Short use peptonized milk to which is added 5 per cent. of dextrose but no egg, as they noted a tendency to the production of hydrogen sulphide when eggs were used. Scheel and Begtrup have come to similar conclusions. They state that enough nutriment is absorbed from a properly prepared nutrient enema to save the body reserves. They use 250 c.c. of a mixture containing not over 10 per cent. of dextrose, and consisting of amino-acid prepared by long-continued digestion of meat or milk by trypsin-repsin. In this way, they supply from 400 to 600 calories per day. Their cases were all patients with gastric ulcer and hematemesis.

The drip method has increased in favor as a medium for supplying nourishment by rectum. A sugar solution can be used, or one containing peptonized milk and sugar. Barbee used a 1.5 per cent. sugar solution administered at the rate of from 30 to 40 drops a minute. In this way, three quarts of solution could be absorbed in twenty-four hours. While the value of this solution represented only 200 calories, and consequently would not be life-saving for any long-continued period, it nevertheless could be used for as long as seven days without much weight being lost. Adler used 4 to 8 ounces of peptonized milk and 1 pint of 4 per cent. sugar solution given by the drip method three times daily.

From the knowledge at hand, it will be seen that the number of calories absorbed falls far below the number actually required—perhaps never exceeds 600 calories daily, while the actual requirement of a body at

¹ Journal of American Medical Association, vol. lxvi, p. 1022.

² Ibid., p. 1026.

rest is about 1800 calories daily. Hence, rectal feeding is only to be utilized to tide over a temporary condition. Dextrose solutions have been noted to cause flatulence, likewise eggs.

Postoperative Heat Stroke in Laparotomy. A. V. Moschcowitz¹ draws attention to this hitherto neglected subject. Moschcowitz's own case was that of a boy with an acutely inflamed appendix with an abscess containing a spoonful of pus. There was nothing unusual about the operation, except that the temperature rose, within thirteen and one-half hours after operation, to a maximum of 109°, and, within twenty-one hours after the operation, the child died. Although no autopsy was obtainable, Moschcowitz is convinced that this was an authentic case of heat stroke.

Moschcowitz was able to collect 12 other cases. The conditions for which these were operated were mostly abdominal, namely, case 2, abdominal abscess; case 3, gall-stones; case 4, amputation of the leg for thrombo-angeitis obliterans; cases 5 and 6, acute appendicitis; cases 7, 8 and 9, facial plastics; case 10, extirpation of the tonsil for sarcoma; cases 11 and 12, acute appendicitis.

Moschcowitz believes that the cause of heat stroke is due to the fact that the inhabitants of New York, Boston, and Philadelphia are less capable of withstanding the heat than the better acclimated populations of the cities farther south. (No heat-stroke cases were reported from the Southern cities.) Moschcowitz also believes that the inhabitants of these Northern cities have not learned to dress properly in hot weather, and wear clothes that are much too warm. And he also states that while it is sound practice in cool weather to keep the patient warm with hot blankets, etc., during his passage from ward to operating room, during his stay in the operating room, and during the return trip, it is directly harmful on warm, humid days of midsummer.

Moschcowitz also found that the degree of humidity was a strong factor in the production of insolation, and he especially warns against needless swathing in blankets and warming with hot-water bottles during hot weather, especially in hot, humid weather.

The treatment of well-established postoperative heat stroke is the routine of hydrotherapy (sponge baths with iced water and ice-caps, enemata, or Murphy infusions with iced water, etc.). In heat prostration with subnormal temperature, the opposite treatment is indicated, namely, keeping the patient warm and stimulated.

The Effect of Foreign Substances in the Peritoneal Cavity was reported by Cubbins and Abt.² Their work was done on dogs. *Iodine* was found to be an intense irritant and favored, rather than inhibited, bacterial action. It led to the production of firm fibrous adhesions with, or without, manipulation of the peritoneum.

Sulphuric ether, such as used for anesthesia, if poured into the peritoneal cavity of a semiconscious animal caused a temporary awakening with cries of pain. This was followed by deep anesthesia. Cubbins and Abt say: "We cannot see the value of ether in the peritoneal

¹ Surgery, Gynecology and Obstetrics, October, 1916, p. 443.

² Ibid., May, 1916, p. 571.

cavity, and it is our opinion that individuals in whom it is used will recover in spite of it and not because of it."

Ordinary *yellow vaseline* was found to be an intense irritant to the normal peritoneum. It was absorbed slowly, if at all. There were two cases of vaseline in the peritoneal cavity in human beings in which it was necessary to open the belly and allow the vaseline to escape in practically the same condition as it was when it had been put in three or four months before. The walling off of the vaseline in the belly of these two human beings was just as firm as if it had been around an abscess. White vaseline, albolene and lanolin seem to have a similar irritating effect.

Russian mineral oil did not prevent the formation of firm, fibrous adhesions. Likewise, sterile olive oil was found to have little value in preventing adhesions, although it had practically no irritating effect upon the peritoneum.

Solutions of *sodium citrate* in the prevention of peritoneal adhesions has been mentioned before in previous numbers of this review.

Straus,¹ in reporting a series of experiments on dogs, says: "On opening the dogs the second time, one could not tell the citrate dogs from the controls. On the whole, the controlled dogs showed somewhat more adhesions than did the citrate dogs." Strauss believes that if a practical technic could be devised whereby one could inject citrate solution repeatedly, and if enough were injected on successive days to keep the peritoneal surfaces constantly bathed with the solution for from four to six days, possibly the results might be more uniform.

Strauss has found that sodium citrate is of no value in preventing the reformation of adhesions which have been separated. Whereas, it is of slight value in preventing the primary formation of adhesions, and may interfere somewhat with wound healing. Strauss justly believes that the relatively small number of experimental and clinical cases reported cannot be considered sufficient evidence to prove the question conclusively as to whether, or not, citrate is of value.

Sheet Rubber Instead of Gauze Sponges in Abdominal Operations is advocated by J. W. Keef,² of Providence, R. I., as a means of preventing adhesions. During the past ten years, Keefe has been using a roll of sheet rubber about the thickness of an ordinary rubber bandage, eight inches wide and eighteen feet long. When the abdominal cavity is opened, folds of this rubber are tucked into the wound, walling off the intestine from the site of the operative field.

STOMACH AND DUODENUM.

Physiology of the Stomach. THE NEWER INTERPRETATION OF THE GASTRIC PAIN IN CHRONIC ULCER. Ginsburg, Tumpowsky and Hamburger³ find that the strong contractions of the stomach accompany the pain of gastric ulcer, that the marked hunger contractions cause pain in a hyperirritable condition of the stomach by increasing intragastric

¹ Surgery, Gynecology and Obstetrics, May, 1916, p. 602.

² Journal of American Medical Association, vol. lxvii, p. 567.

³ Ibid., p. 990.

pressure, and that this conception of gastric pain, as due to tension, will explain many obscure conditions simulating gastric ulcer, namely, achylia gastrica, chronic appendicitis, and gall-bladder disease. Hyperacidity alone may be a factor by reflexly causing hypertonus, hyperperistalsis, and pylorospasm. The subjective relief of pain by alkalies does not necessarily prove that acid is the cause of pain, but may be interpreted on the basis that alkalies prevent the development of pain-producing hypertonus by neutralizing the acid. Pituitary extract stimulates contraction as is to be expected from its property of stimulating smooth muscle (see elsewhere in this review for recent investigations with pituitrin). From the results obtained, hydrochloric acid, in the strength that it may occur in the stomach, causes no appreciable effect (0.5 per cent.).

THE EFFECT OF HOT AND COLD FLUIDS UPON THE GASTRIC PERISTALSIS was studied by Egan.¹ He found that, in the majority of cases, the variations in temperature had no influence upon the peristalsis. However, in a small minority of individuals, deep peristaltic waves could be seen after the drinking of cold fluids, whereas warm fluids caused only very slight superficial peristaltic indentations. These characteristics seemed to be a matter of individual predisposition rather than the cause of disease, because they were seen both in people with healthy stomachs and those affected with various pathological gastric conditions.

Recent Progress in the Röntgenology of the Gastroduodenal Region. Gerber² calls attention to the *polygram method of Levy-Dorn*. He makes two exposures on a single plate, with an interval of eight seconds between exposures. Such polygrams are made both in erect and prone positions. In normal stomachs, the passage of the peristaltic waves can be seen in a most graphic manner. The two outlines cross and recross each other in such a way as to show clearly that every portion of the stomach is taking part in the peristaltic movement. A regional lack of motility is thus easily seen. Craters or niches are readily made out. In duodenal ulcer and gastric carcinoma, the filling deformities are easily seen. While Gerber does not offer the polygram as a substitute for serial plate study, he thinks that, in many instances, considerable time, trouble, and expense can be saved.

Gastrosppasm. Carman,³ of the Mayo Clinic, distinguishes *three forms of spasm due to gastric ulcer*, namely, the hour-glass spasm, the diffuse spastic distortion, and, lastly, spasm of the pyloric sphincter. Speaking of the second condition, he says that gastric ulcer often gives rise to a diffuse spasm of the pyloric segment whether the ulcer be situated in this region or higher up in the stomach. The stomach, well outlined in its upper portion, shades off into a poorly filled, vaguely outlined antral area which may resemble the filling defect of a pyloric cancer.

EXTRINSIC CAUSES OF GASTROSPASM. Duodenal ulcer is occasionally associated with a gastric incisure or an hour-glass stomach.

¹ München. med. Wehnschr., 1916, p. 37.

² American Journal of Röntgenology, 1916, p. 220.

³ Journal of American Medical Association, vol. lxvi, p. 1283.

In many instances, after a barium meal has been swallowed, none of it is seen to pass the pylorus under the fluoroscope for several minutes. At operation, a cholecystitis or a chronic appendicitis is found, but no lesion of the stomach. In short, there is a pylorospasm. In other instances the entire pyloric third of the stomach is shrunken to a stiff, narrow tube which may be palpable to the examining fingers. The tube projects like a spigot from the well-expanded fundus and shows a striking likeness to a canal through a pyloric tumor. In this species of spasm, disease of the gall-bladder is frequently found.

Total gastrosphasm is characterized by a gastric hypertonus far beyond the physiological limit. The gastric contour lacks the smooth regularity of a normal filled stomach. Mobility and flexibility are not only actually lessened somewhat by the stiffened spastic gastric wall, but, by reason of the high, sheltered position of the stomach well up under the ribs on the left side, it often seems to be practically immobile and inflexible. The pyloric sphincter, contrariwise, may remain steadily open, and there is an early, free and continuous exit of the barium meal. The whole picture is much like that of extensive gastric cancer, and might easily deceive the unwary examiner.

The etiological agents of extrinsic gastrosphasm are hard to prove. Mention has been made of duodenal ulcer and disease of the gall-bladder and appendix as associated with gastrosphasm. These associations are frequent, and the assumption of an etiological relationship seems only rational. Others have been noted, such as hysteria, pancreatic disease, tabs, arteriosclerosis affecting the abdominal viscera, renal and ureteral calculi, uremia and poisoning by lead, nicotine, and morphine.

DIFFERENTIATION BETWEEN GASTROSPASM OF INTRINSIC AND OF EXTRINSIC ORIGIN. Gastrosphasm produced by an ulcer tends to persist at subsequent examination. It cannot be effaced by giving antispasmodics (Carman).

Gastrosphasm caused by extrinsic conditions is often brief in duration or intermittent in its appearance. It may be of the migratory type or show a changing aspect from time to time. Though continually present in one situation, no tumor mass corresponding to the defect can be felt. The borders of the spastic area are sharply delineated or, if the spasm is shifting during the time of the exposure, the gastric contour may be hazy and blurred.

Diffuse "extrinsic" spasm tends to accelerate gastric motility rather than retard it. If, however, the spasm involves the pyloric sphincter, motility is often retarded, but varies from time to time in the same individual, so that a six-hour retention may be noted at one examination but not at another.

Gastrosphasm from extrinsic causes may be present at one examination and absent at a second. This instability is very characteristic. Upon administration of belladonna or atropine, such spasms vanish. Before reexamining, Carman generally gives tincture of belladonna, 15 to 20 drops three times a day for two or three days, in order to obtain the physiological effect of the drug as shown by dryness of the throat, dilatation of the pupils, etc. If this physiological effect is not present,

the second röntgenoscopic examination of the stomach may be inconclusive.

Spasm of any sort (whether intrinsic or extrinsic) *disappears under general anesthesia*. Consequently, the surgeon at exploratory laparotomy finding no hour-glass may object that the x-ray is incorrect, and he may conclude that it is needless to look for any trouble in the stomach; but a careful search will usually reveal a lesion either in the stomach or exceptionally in the duodenum. Carman has seen a number of cases in which the gastric incisures and hour-glass contractions associated with duodenal ulcer have persisted in spite of the administration of belladonna.

Spasm of the duodenum is frequently present with duodenal ulcer, and often causes the only deformity of the bulb seen in many instances. In observing these duodenal cases, Carman states: (1) there are cases in which an organic distortion is present and the deformity seen at Röntgen examination far exceeds that found at operations; (2) in cases with tiny duodenal ulcers, too small in themselves to produce a recognizable filling defect, there is pronounced irregularity of the bulbar shadow.

In such cases, plates taken in the dorsoventral position show disfigurement on the lateral borders of the duodenal bulb, although the ulcer is usually found on the anterior wall. The bulbar distortion often displays the other characteristics of spasm. It is clean-cut in outline, projects deeply into the lumen, and is wholly comparable to the incisure of gastric ulcer. Duodenal ulcer, like other ulcers, is an efficient spasm-producing agent, as indicated by its association with spasm of the stomach and elsewhere.

From these facts, Carman believes that intrinsic spasm plays an important part in the Röntgenological evidence of duodenal ulcer, and that in the absence of spasm often no deformity of the bulb would be seen.

The Duodenal Tube as an Aid to the X-ray Examination after Gastro-enterostomy is advocated by Freud,¹ an assistant of Holzknecht's. With the patient in the upright position, the duodenal tube is swallowed to the mark 45. Its further passage is controlled under guidance of the fluoroscope. If the stoma of the gastro-enterostomy opening is patent, the olive of the duodenal tube will pass into it and down the first loop of the jejunum to where it angulates. If the olive of the tube is now drawn back into the stomach, and one injects a small amount of contrast material, it is easy to determine the most dependent point of greater curvature. The olive is now allowed to pass through the stoma again, and, by means of manipulation, an attempt is made to have it pass down the afferent loop of intestine. Contrast material is now injected, so that one can determine the site, form, motility, and the presence or absence of tenderness in this region. One should then wait for a time until the anastomotic loop has emptied itself before looking to see whether a small amount of bismuth has been left behind in some pathological niche. After this, the olive is pulled up into the stoma and one determines

¹ München. med. Wehnschr., 1916, p. 1447.

whether there is any local tenderness here. Now contrast material is again injected and one waits to see whether any of it remains behind in the crater of an ulcer.

The duodenum and afferent loop to the gastro-enterostomy opening can be filled either by causing the duodenal tube to pass through the gastro-enterostomy opening, or, by allowing it to pass through the pylorus, before injecting contrast material. Should there be a stenosis of the gastro-enterostomy stoma, the duodenal tube will follow its usual course through the pylorus into the duodenum. Under the fluoroscope it can now be seen whether any of the contrast material passes along the afferent loop and makes a retrograde entrance into the stomach. If this does not take place, one may be sure that the gastro-enterostomy is closed. By the rate of flow, it will be easy to determine whether there is a relative stenosis or not. Freud has examined 80 cases according to this method since the first months of 1915.

The Diagnostic Filling of the Stomach and Intestinal Tract with a Suspension of Fine Iron Particles by Payr was referred to in *PROGRESSIVE MEDICINE*, June, 1915, p. 57. Recently, Wernoe¹ speaks of this method. He fills the stomach with a suspension of pulverized iron a few hours after meals and then passes a magnet over the epigastrium. The iron particles are attracted together on the stomach wall nearest to the magnet. If this happens to be the site of ulcer, Wernoe states there is pain at once, like the pain felt at other times from the ulcer. The same method of examination answers for the intestine. According to Wernoe, throughout the alimentary tract the presence of circumscribed pain evoked by this method was an evidence of some localized lesion at the point referred to. In all, 50 patients were examined; among these were several cases of gastric ulcer which gave negative findings after a course of medical treatment, thus (according to Wernoe) proving the success (?) of the treatment.

Congenital Pyloric Stenosis. *The Rammstedt Operation.* Last year there was a very brief report of Downe's series of 66 operations of pyloric obstruction in infants. A subsequent report² *in extenso*, contains a number of diagnostic and technical points of interest.

In every one of the cases a tumor—varying in size from the terminal phalanx of the little finger to that of the thumb—was noted by at least two or more observers. To facilitate palpation, a light anesthesia (ethyl chloride inhalation) was employed. Before administering the anesthetic, a tube was invariably passed to remove gas and facilitate palpation of the tumor which lay to the right and above the umbilicus. Downe considers the presence of this so-called tumor pathognomonic of the condition.

He describes the technic of the Rammstedt operation as follows: After opening the abdomen, the pyloric tumor should be held firmly between the thumb and index finger (Fig. 24), and, as the incision is deepened, the edges of the wound can be gently forced apart. After the muscle is cut through, a definite line of cleavage is found between

¹ Hospitalstidende, October 11, 1916, p. 989.

² Surgery, Gynecology and Obstetrics, March, 1916, p. 251.

the muscle and the mucous membrane. A small pair of blunt-pointed, curved scissors may be used with advantage in spreading the incision (Fig. 25). When the muscle is sufficiently divided, the liberated mucous membrane protrudes freely into the wound. There is very little hemorrhage—occasionally a small vessel may require a ligature—but, as a



FIG. 24.—First step of Rammstedt operation. Tumor supported. Line of incision shown. (Downes.)

rule, the application of hot pads to the edges of the wound for a few minutes controls the bleeding. This completes the operation; the tumor is dropped back into the abdomen and the wound is closed.

In spreading the incision and separating the muscle from the mucous membrane, Downes believes it best to start from the stomach end of

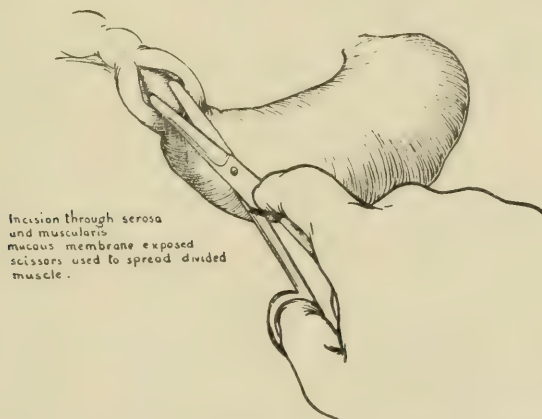


FIG. 25.—Second step showing completed operation. (Downes.)

the incision, as here the merging of stomach wall into pyloric tumor is a gradual one, and there is not much danger of opening the mucous membrane, whereas the change from the thickened and edematous pylorus to normal duodenum is so sudden that extreme care is necessary to avoid opening the intestine at this point. (On account of this accident

some operators have discarded the operation and have returned to gastro-enterostomy.)

At one time Downes made it a habit to pass a sound into the stomach through a gastrostomy opening to determine the patency of the pylorus by passing the point of the sound past the pyloric ring which had been liberated by the Rammstedt operation. Two of the cases in which he did this died, and he has since given it up.

In one case which died twenty hours after operation without relief of symptoms, a small tumor arising from the muscularis mucosæ was found completely blocking the pyloric canal (Fig. 26).

In Downes's hands, gastro-enterostomy (in 31 cases) gave a mortality of 35 per cent. while the Rammstedt operation (35 cases) gave 23 per cent. All things being considered, the Rammstedt operation is the operation of choice in the treatment of pyloric obstruction in infants.

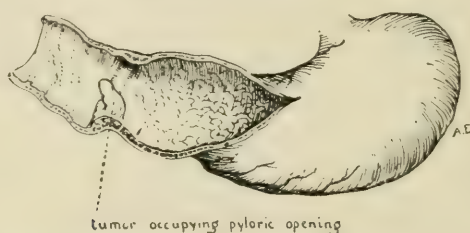


FIG. 26.—Tumor occupying pyloric opening. (From sketch made at time of necropsy.) (Downes.)

Buford,¹ referring to the operation for congenital pyloric stenosis, performed by Drs. Stone and Ladd, of the Boston Children's Hospital, says, they sever "longitudinally the peritoneum and pyloric ring in the upper posterior quadrant down to the premucosal connective tissue, and the mucosa is freed on either side the entire width of the ring. The mucosa at once protrudes into the gap and ought to prevent union of the severed ring." . . . "He does not close the peritoneal covering of the pylorus." . . . "I shall try the Stone-Ladd operation in my next case." (Apparently he had not read Rammstedt's original communication.—REVIEWER.)

Congenital Stenosis of the Duodenum. Ernst's patient was a robust, newborn baby. At laparotomy, the dilated pylorus was traced into the duodenum, which was two fingerbreadths wide as far as the upper border of the transverse mesacolon. At the duodenojejunal flexure the intestine was collapsed to the caliber of an ordinary pencil.² A coil of small intestine four inches below the duodenojejunal flexure was drawn up in front of the transverse colon and united to the duodenum about the junction of the first and second parts. The child made a complete recovery, and is now alive and well.

CONGENITAL STENOSIS OF THE DUODENUM IN AN ADULT. Terry and Kilgore³ report the following case: The patient was a man, aged twenty-

¹ Surgery, Gynecology and Obstetrics, May, 1916, p. 549.

² British Medical Journal, 1916, vol. i, p. 644.

³ Journal of American Medical Association, vol. lxvi, p. 1774.

four years. There were symptoms of benign stenosis beginning in adolescence before the usual ulcer age, and growing progressively worse. The symptoms and findings indicated a benign pylorus stenosis. At operation, the first portion of the duodenum was found dilated, the upper wall forming a definite pouch. Just distal to this dilated portion, at about the junction of the first and second portions of the duodenum and above the entrance of the common duct, the intestine was constricted to one-third or less of its normal diameter for about 1.5 c.c. (Fig. 28). There were no local thickenings of the wall and no scars or other abnormalities of the peritoneum to account for the constriction. A posterior gastroenterostomy was done. There was marked thickening of the stomach wall in spite of its dilatation, indicating hypertrophy from long-standing obstruction. The patient died five days later. Autopsy showed marked dilatation of the stomach, with partial breaking down of the gastroenterostomy wound and leakage of stomach contents into the peritoneal cavity.

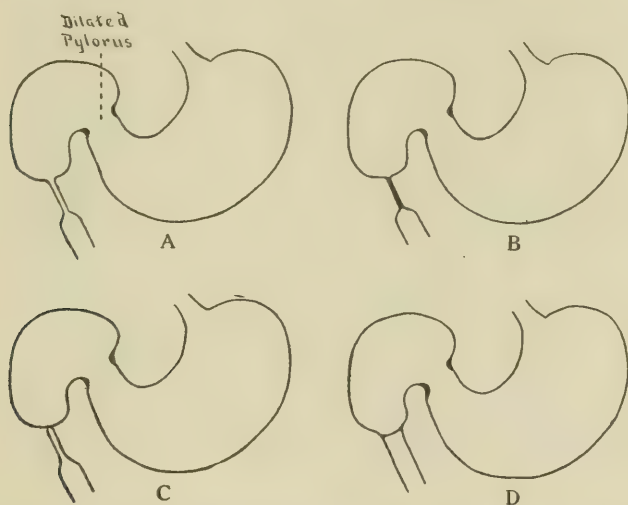


FIG. 28.—Various forms of duodenal occlusion: A, constricted canal; B, fibrous cord; C, blind pouch; D, transverse membrane. (Terry and Kilgore.)

According to Terry and Kilgore, the total number of cases of duodenal stenosis in the literature is about 75. Their courses lasted from a few days to a few months. The survival of an individual with this condition until young adult life is extremely rare. According to these authors, the commoner types of duodenal stenosis may be divided into the following classes:

1. There is a constricted canal, lined with fairly normal intestinal mucosa (Fig. 27, A). The occlusion is incomplete.

2. A fibrous cord represents the constricted intestine. It may be 1 or 2 cm. in length, or may extend from the pylorus to the papilla of Vater (Fig. 27, B).

3. The duodenum may end as a blind pouch, and the intestine begin again with a constricted lumen from the tip of this pouch, like an

appendix springing from the cecum (Fig. 27, *C*). Such a case is reported by Roe and Shaw.¹

4. Two cases have been reported of occlusion by a comparatively thin transverse membrane (Fig. 27, *D*); in 1 of these smooth muscle fibers were found between the layers of epithelium, indicating the structure of actual intestinal wall in the membrane.

5. The relation of the occlusion to the common duct is of interest. Most of the obstructions occur in its immediate neighborhood, either above or below the papilla, though they may occur in any portion of the duodenum. In 4 cases of partial occlusion, the common duct opened into the stenosed portion. Cordes also reported a case in which the blind pouch of duodenum was connected with the papilla of Vater by a

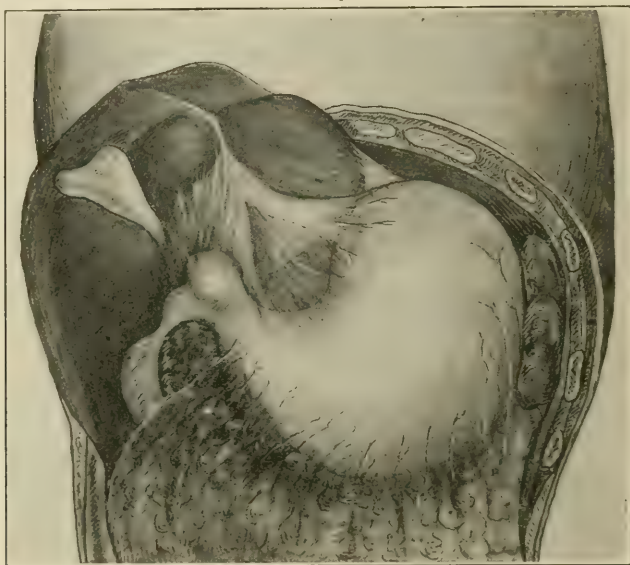


FIG. 28.—Conditions found at operation (semidiagrammatic). (Terry and Kilgore.)

small canal having the microscopic characteristics of the gall duct. She found two or three similar cases reported, and considered that in several other instances such a connection must be assumed to explain the vomiting of bile-stained material in cases in which the duodenal occlusion was above the papilla. No satisfactory embryological explanation of this curious anomaly of the gall duct has been offered.

The possible causes of congenital stenosis of the duodenum suggested in the literature were: (1) errors of embryological development of the duodenum; (2) volvulus in fetal life; (3) fetal peritonitis (usually tuberculous or syphilitic); (4) ulceration; (5) pressure from new growths; (6) abnormal persistence of the omphalomesenteric duct; (7) traction on the intestine due to hernia; (8) circulatory anomalies (absence of

¹ Lancet, London, September 30, 1911.

arterial branches); (9) embolism of the superior mesenteric artery; (10) pressure from an enlarged head of the pancreas.

In 49 of the 57 cases no evident cause could be found except faulty development of the duodenum itself. That this is the usual cause is also suggested by the most common location of the constriction, near the orifice of the common duct, that is, at about the junction of the embryonic foregut and midgut, and at a point where very active embryological processes take place—the development of the liver and pancreas—and where other congenital anomalies (diverticula) are prone to occur. Furthermore, atresia of the duodenum is frequently associated with other defects which are clearly developmental. The developmental origin is also indicated by the work of Tandler, and later by Forssner, who found that the second portion of the duodenum, which is at first open during the latter part of the first month of embryonic life, becomes occluded by proliferation of its own epithelium, and remains so during nearly the whole of the second month. It is suggested that a failure in the absorption of this occluding plug of epithelium is responsible for some of the atresias found at birth.

The only constant symptoms of the condition are persistent vomiting of everything ingested, beginning at birth, with emaciation and death in a few days (the symptoms being somewhat modified, of course, in the few cases of incomplete obstruction). Cases in which the obstruction was below the orifice of the common bile duct have been diagnosed during life by the passage of white meconium and the vomiting of bile-stained material.

The treatment is, of course, only operative, but so far not successful. Braun, in 1902, collected from the literature the reports of 25 operations for congenital intestinal stenosis of all parts of the small intestine—enterostomies, gastro-enterostomies, and entero-anastomoses—with a mortality of 100 per cent.

CONGENITAL TRANSDUODENAL BANDS. Homans¹ reports 11 cases of the condition, with definite bands passing from the gall-bladder and liver across the duodenum, in which gastric or duodenal ulcers or gall-bladder disease were considered to be absent. The average duration of symptoms was from eight to nine years. In some cases the clinical picture was that of gastric ulcer, in others that of gall-stones. The x-ray findings were more like those of duodenal than gastric ulcer. Studies of gastric and duodenal motility showed abnormalities in all instances of well-developed transduodenal bands. While Homans speaks well of simple division of the bands, he states that division of the bands plus a Finney pyloroplasty has given more satisfying results.

Abnormalities of the ligamentum hepatocolicum are reported by Schlecht.² Like certain of the Jackson membranes, this is a normal structure found in 15 to 20 per cent. of the newborn children, according to Konjetzny, which at times may give rise to abnormal symptoms either suggestive of duodenal ulcer or of gall-stones. The cases reported

¹ Boston Medical and Surgical Journal, November 9, 1916, p. 665; Journal of American Medical Association, vol. lxvii, p. 1627.

² München. med. Wehnschr., 1916, p. 1353.

by Konjetzny are as follows: The first case gave a history stimulating gall-stone attacks, of which he was relieved by a division of the hepaticocolic ligament. The gall-bladder, stomach, and duodenum were entirely normal. The second case gave a similar history. The third case gave symptoms of a gastric ulcer. Following division of the hepaticocolic ligament, the patient remained free from symptoms. In Schlecht's first case, a woman, aged thirty-eight years, the symptoms were strongly suggestive of cholelithiasis. The patient had a positive Wassermann. X-ray examination of the alimentary tract showed a normal peristalsis of the stomach with a six-hour residue; complete emptying at the end of twenty-four hours. In the duodenum there were peristaltic and antiperistaltic waves with a tender point over the gall-bladder and over the descending portion of the duodenum. According to the roentgenologist, there was disturbance of gastric motility, intermittent duodenal stenosis, and he could not exclude the presence of a duodenal ulcer on this account. The clinical diagnosis was cholelithiasis and duodenal adhesions. At operation, nothing abnormal was found except a well-marked hepato-duodenal ligament, which was divided. The patient remained free from attacks for nine months and then again suffered from repeated attacks. Suspicion of renal calculus was entertained, but upon exploration no calculi were found. At secondary laparotomy the gall-bladder, which was now adherent to the transverse colon and the hepatic flexure was removed. Two and a half years after the first, and one and three-quarter years after the second operation, the patient was free from symptoms. An x-ray examination showed a normal peristalsis of stomach and duodenum. In Schlecht's second case, a man, aged forty-four years, gave symptoms strongly suggestive of a gastric carcinoma. The x-ray showed a stomach and duodenum with normal peristalsis. It was impossible to get a sharp picture of the pylorus, and this, taken in conjunction with clinical findings, led to the diagnosis of gastric carcinoma. The operation showed neither scars nor ulcers. The first part of the duodenum, however, lay high and was pulled up toward the hilus of the liver. There was an abnormally short ligamentum hepaticocolicum. A retrocolic gastro-enterostomy was performed, the outcome of which is not stated.

Experimental Gastric Ulcer. A glance over the brief reviews given below will show that while there is no difficulty in obtaining organisms from the walls of human gastric ulcers, it has been impossible to reproduce typical chronic ulcers by injections of local isolated strains—in other words, there seems to be other etiological factors besides the presence of bacteria. So far, these have eluded discovery.

GASTRIC ULCER EXPERIMENTALLY PRODUCED BY STAPHYLOCOCCI. Steinharter¹ reports using the cultures from a case of sepsis in man. At first the cultures were injected intravenously in a rabbit, producing a sepsis; but later, after cultivation in the wall of the living stomach of the rabbit, showed, on intravenous injection, affinity for the intestinal tract, localizing most often in the appendix, occasionally in the stomach.

¹ Boston Medical and Surgical Journal, May 7, 1916.

Typical peptic ulcers varying from one-quarter of an inch to an inch in diameter were produced by injecting locally into the stomach wall, staphylococcus organisms of certain grades of virulence and a weak acetic acid solution. A small localized, firmly walled-off abscess at the point of injection developed. This abscess was absorbed in the course of four to six days. Injection of acetic acid alone, or of bacteria alone, never caused ulcers. In short, Steinharter thinks that a hyperacid gastric juice is a necessary factor in the production of gastric ulcer as well as staphylococcus of a given virulence.

Zippy¹ believes that gastric *acidity* plays an important part in establishing a chronic ulcer. Hence, the long-continued administration of alkalies facilitates the cure of a large number of gastroduodenal ulcers.

The results of Steinharter (who produced acute ulcers in rabbits by intravenous injection of *Bacillus coli*) were not confirmed by Hardt.² However, gastric and duodenal ulcers were produced in dogs by intravenous injections of streptococci isolated from gastric ulcers in man, dogs, sheep, and cattle. This is in confirmation of the work of Rosenow. Hardt claimed there is no hyperacidity in the gastric juice following the experimental production of gastric ulcers. As a result of his work with the Pawlow pouch he holds the production and chronicity of the gastric ulcers must primarily be dependent upon the virulence of the streptococcus infection.

Wilensky and Geist³ consider that if organisms isolated from chronic ulcers of human stomachs were injected directly into recently made defects in the stomach walls of animals, the opportunity for production of characteristic chronic ulcers would be enhanced. As a preliminary step, in a number of animals, the healing of a surgically produced defect was observed. These defects were made by incising tissue from the stomach wall down to, and including parts of, the muscularis; they measured 1 to 2 cms. in diameter. It is shown that such defects healed completely in one or two weeks. In a second series, the mucous membrane of the stomach was everted through a gastrotomy opening, defects were then made and the entire base of the defect was then infected with a suspension of bacteria by injecting it into the tissue layers. The bacteria used were obtained from cultures taken from human gastric ulcers excised during the course of the operation. The method of culture was that described by Rosenow, and cultures were made by Celler, one of the bacteriologists connected with Mt. Sinai Hospital, New York. Some of these were cultures of streptococci, and, in a certain number, a yeast was cultivated. Some of the defects were infected with strains cultivated from a single human ulcer, others with strains obtained from two or more ulcers, still others with these strains plus the yeast or with yeast alone. The suspensions were made with bacteria of the third or fourth generations. At varying intervals the lesions were reexamined. The stomach was opened and either the old gastrotomy wound was reopened or a new one was made and the condition of the

¹ Journal of American Medical Association, May 15, 1916, p. 1623.

² American Journal of Physiology, April, 1916.

³ Journal of American Medical Association, vol. lxvi, p. 1382.

defect observed. When there seemed to be a tendency to heal, the ulcer was again infected and the stomach closed. In order to watch the progress of the ulcer, it was necessary to repeat this procedure several times in each animal. Nine animals (cats) were used, and in all of them, irrespective of the size, depth of the defect, virulence, or number of the organisms injected, these surgical defects healed as promptly as those observed in the control animals. The series of experiments demonstrated that the presence of the organisms found in human gastric ulcer—

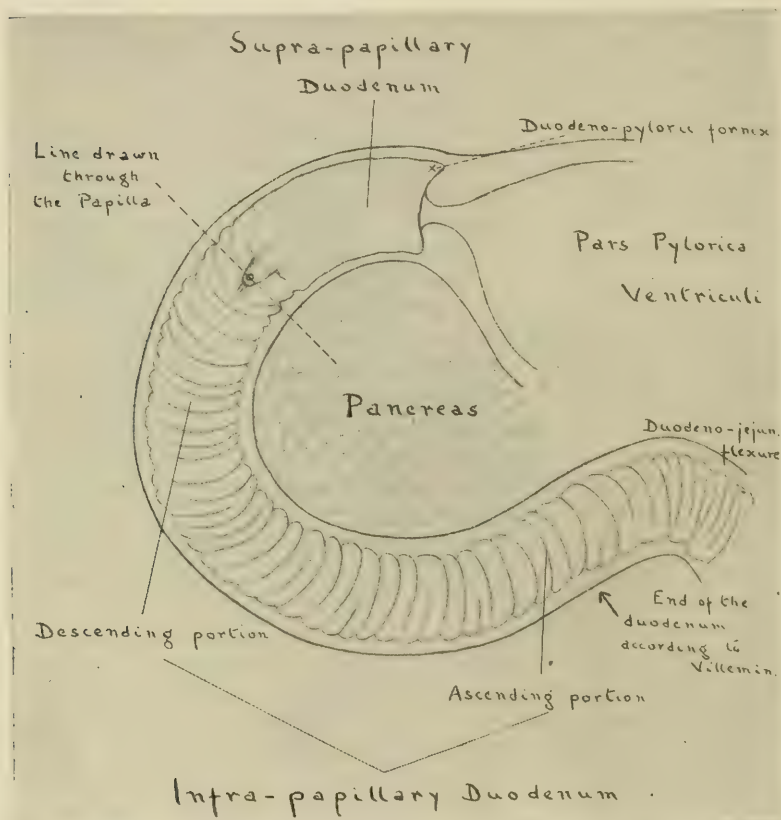


FIG. 29.—Schema of the proposed division of the duodenum by a line passing through the bile papilla. The proximal (cephalad) portion of the suprapapillary duodenum, the distal (caudad) the intrapapillary. (Jefferson and Plummerfelt.)

according to Wilensky and Geist—have no appreciable effect either in giving to experimentally produced defects the characteristics of the chronic indurated ulcer or in retarding their healing.

Celler and Thalhimer¹ find that hemolytic streptococci are present in practically all gastric ulcers. However, they are not convinced that these organisms have proved to be the factor which either initiates

¹ Journal of Experimental Medicine, June, 1916.

ulceration or prevents healing. The constant presence of streptococci in this type of lesion is suggestive, and further experiments are being undertaken to determine their significance.

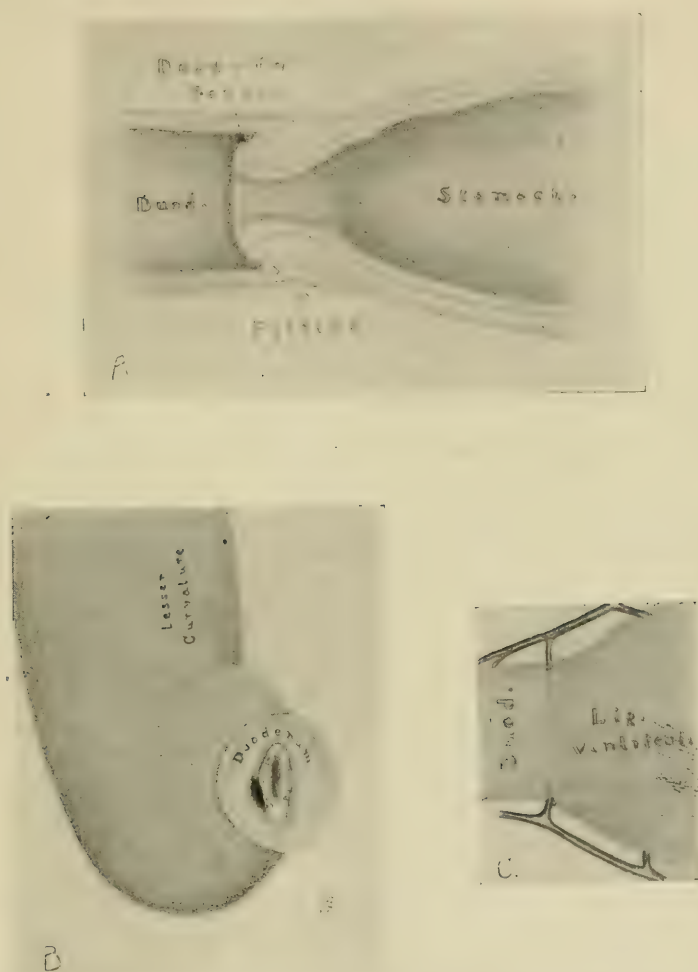


FIG. 30.—A, horizontal section of the pars pylorica ventriculi and of the duodenum, to show the duodenopyloric fornix; B, three-quarter end view of the proximal duodenum and the stomach, showing an ulcer in the duodenopyloric fornix; C, the pyloric veins to illustrate how their short, stubby appearance is due to their disappearance beneath the ligamentum ventriculi or pylori. Drawn from specimens in the author's possession. (Jefferson.)

Durante,¹ from the Mayo Clinic, enumerates 17 methods of producing experimental gastric ulcer. In his summary, he states that by resection of the splanchnic nerves, ulcers may be produced in animals, the histological pictures of which contain all the essential features of acute and chronic gastric ulcers as seen in man. .

¹ Surgery, Gynecology and Obstetrics, April, 1916, p. 399.

While not denying the other etiological possibilities, Durante makes a strong plea for the theory of trophic ulcers of the stomach. He says: "Ulcer may be produced by any agent capable of damaging the sympathetic nervous system, as it is on the integrity of this system, which controls circulation, secretion, and profound sensibility of the stomach that the very life of the gastric cells may be said to depend."

Ulcer of the Duodenum. G. Jefferson,¹ in an anatomical study, states that the divisions of the duodenum, as given in anatomical text-books, are neither embryological nor physiological. The duodenum, according to Jefferson, is best divided into two parts, namely, cephalad and caudad to the bile papilla; these parts he terms supra- and infrapapillary (Fig. 29). This is not only developmentally correct but also stands the test of pathology, for an examination of statistics of duodenal ulcers show they are common in the first or acid, suprapapillary region, and that their incidence decreases as the papilla is neared, and that they are extremely rare in the alkaline, infrapapillary region. The normal physiological differences of these parts above and below the papilla is thus emphasized by pathological experience.

Jefferson says that the statistics dealing with the incidence of duodenal carcinoma, namely, that it is most common in the second part, are fallacious. If carcinomata of the papilla are subtracted, it will be seen that the carcinomata of the duodenum are more frequent in the suprapapillary region than in the infrapapillary, apparently because of the greater frequency of chronic ulceration in this region.

In another anatomical study, Jefferson² points out that ulcer in the duodenopyloric fornix is very favorably situated for the obliteration—partial or complete—of the pylorus and its landmark, the pyloric vein (Fig. 30).

Difficulty may then arise in ascribing the ulcer to its correct position. Such an ulcer is usually described as "pyloric," which suggests that it is of gastric, instead of duodenal, origin.

Given a well-marked fornix which is likely to be present with a hypertonic stomach, an ulcer may be more or less hidden from view by the projecting pylorus even after the duodenum has been opened.

Acute Perforation of Gastroduodenal Ulcer. In speaking of the physical signs, C. L. Gibson,³ says, regarding the value of obliteration of liver dulness: "This symptom I have never been able to recognize in any perforation of any kind, of the gastro-intestinal tract, and I feel that it is a great pity that it is allowed to remain as one of the possibilities of diagnosis."

To demonstrate the presence of free gas in the peritoneal cavity, Gibson fills the laparotomy wound with water just previous to incising the peritoneum. Even a minute quantity of gas can be demonstrated by the gas bubbles coming through this water.

Demonstration of a very fine perforation in the stomach or duodenum may be facilitated by pressing gas from the stomach. In difficult cases, insufflation of the stomach may be resorted to. As a rule, he closes the

¹ *Annals of Surgery*, March, 1916; p. 318.

² *Surgery, Gynecology and Obstetrics*, April, 1916, p. 388.

³ *Ibid.*

perforation with a double purse-string suture of catgut. This is applied across the diameter of the viscus, rather than lengthwise, to avoid narrowing.

Gibson rejects gastro-enterostomy as a curative measure in this class of cases, notwithstanding the gratifying results he has had with gastro-enterostomy in the cure of chronic ulcer. He agrees with Eliot that the performance of gastro-enterostomy is no guarantee against future perforation or fatal hemorrhage and that immediate gastro-enterostomy is not indicated except in the presence of prior constriction of the pylorus or constriction as a result of operative closure of the perforation.

Gibson believes the entire question of excluding the pylorus after a gastro-enterostomy is still undecided.

Of recent years Gibson has discarded drainage, and is satisfied with his results. He mentions the fact that certain operators drain the pelvis through a separate stab wound, and that others recommend the evacuation of the stomach with a tube after closure of the perforation.

In the after-treatment, Gibson lays special stress on certain dietary details. In the first twenty-four hours the usual postoperative treatment is instituted, namely, nothing by mouth, semirecumbent position, and the Murphy drip. On the second day, water and other clear fluids are allowed in increasing amounts. By the fifth day the average case is allowed soft diet. At the time of discharge from the hospital, all the patients are given regular hospital diet. Gibson particularly insists upon this because he thinks that we should give up the fetish of under-feeding or lay stress upon the particular value of certain kinds of diet. Thirteen of the cases remained under observation, and in all of them, at reëxamination, there was an improvement in general health and the relief or cure of previous gastric symptoms. In short, the report of these carefully followed cases seems to show that acute perforations tend to heal themselves, and a spontaneous cure of the ulcer is a result of the perforation. "It might almost be said that perforation is a blessing in disguise."

In the discussion which followed Gibson's paper, Bevan remarked that he had never seen a perforated gastric or duodenal ulcer with obscured liver dulness. Bevan also closes the perforation with a double purse-string suture of linen or silk. In the presence of gross contamination he makes a counter-incision just above the symphysis, and uses a large, glass tube. In the bad cases the patient is kept in a recumbent position, and the head of the bed elevated about two feet so that the same benefit of gravity is obtained, as in the Fowler position, without setting the patient up. Bevan also agrees with Gibson about the uselessness of gastro-enterostomy as a routine.

Eisendrath uses the following mixture for *proctoclysis*: 6 ounces of tap water, 2 per cent. bicarbonate of soda, and 2 per cent. glucose. Eisendrath agrees with Bevan that many of the patients cannot stand continuous proctoclysis. (Bevan gives 8 to 10 ounces every two or three hours, and finds it much more comfortable than continuous proctoclysis.)

Strauss advocated the use of fascial transplant for closure of perfora-

tions, the walls of which were so rigid and friable as to prevent the usual infolding type of purse-string suture.

The question of whether to do a gastro-enterostomy in the presence of an acute perforation of a gastro-duodenal ulcer is discussed by A. O. Wilensky.¹

In speaking of the objections to this, he says: Gastro-enterostomy is not necessary, because, in the first place, it does not always cure the underlying condition, and, secondly, because the patients recover from ulcer without it.

As the Mayos have said, a perforated ulcer is a cured ulcer. Hence, recurrence after closure is not to be expected in the majority of cases.

Pyloric Exclusion seems to be losing what popularity it once had. Crile² says that pyloric exclusion is rarely required, as the relief without it is about equal to that secured with it. Whenever he is required to use it, he employs the so-called Kelling Berg-Cackovic method (see below in review of Lewisohn's article).

Deaver,³ in discussing Crile's paper, also expressed a like opinion, namely, that, as a rule, pyloric exclusion was not particularly satisfactory.

Gibson⁴ believes the entire question of excluding the pylorus after a gastro-enterostomy is still undecided.

According to Woolsey,⁵ neither gastro-enterostomy nor pyloric exclusion will prevent hemorrhage from an ulcer.

Strauss⁶ doubts whether temporary closure with a silk ligature which does not hold the pylorus closed longer than from ten to thirty days is of any value in chronic ulcer of the pylorus or duodenum which takes weeks and months to heal. Strauss recently fluoroscoped a number of cases in which a silk ligature, the size of an umbilical tape, was used. In one case the pylorus was open at the end of ten days, in another at the end of eighteen days, and practically all of them were open at the end of twenty-one days. Two of the cases had hemorrhages which nearly proved fatal. From his fluoroscopic observations and from his x-ray plates, Strauss states that 40 to 50 per cent. of the food passes through the pylorus no matter how well the gastro-enterostomy has been performed and placed, therefore irritation of the ulcer cannot be lessened sufficiently to produce healing. He believes the only way gastro-enterostomy helps is by increasing the alkalinity of the gastric contents. He also states that since 50 per cent. of the food passes through the pylorus, this food as it passes over the duodenum neutralizes the bile, so the only time that bile can flow in any quantities through the gastro-enterostomy opening is when the stomach is empty or when no food is passing over the pylorus. Therefore, Strauss concludes that if a pyloric closure is indicated, a permanent closure, such as von Eiselsberg's unilateral exclusion or some similar procedure, should be made. He advocates his own Biondi method, using a submucous facial ligation.

¹ *Annals of Surgery*, October, 1916, p. 403.

² *Journal of American Medical Association*, vol. lxvii, p. 856.

³ *Surgery, Gynecology and Obstetrics*, April, 1916, p. 388.

⁴ *Annals of Surgery*, September, 1916, p. 363.

⁵ *Journal of American Medical Association*, vol. lxvii, p. 859.

³ *Ibid.*, p. 858.

Neuhof,¹ in a series of 13 dogs examined from five days to five months after operation, finds that permanent pyloric exclusion does not follow experimental ligation of the pylorus with fascial bands. Even temporary pyloric exclusion is uncertain after this procedure. Experimental

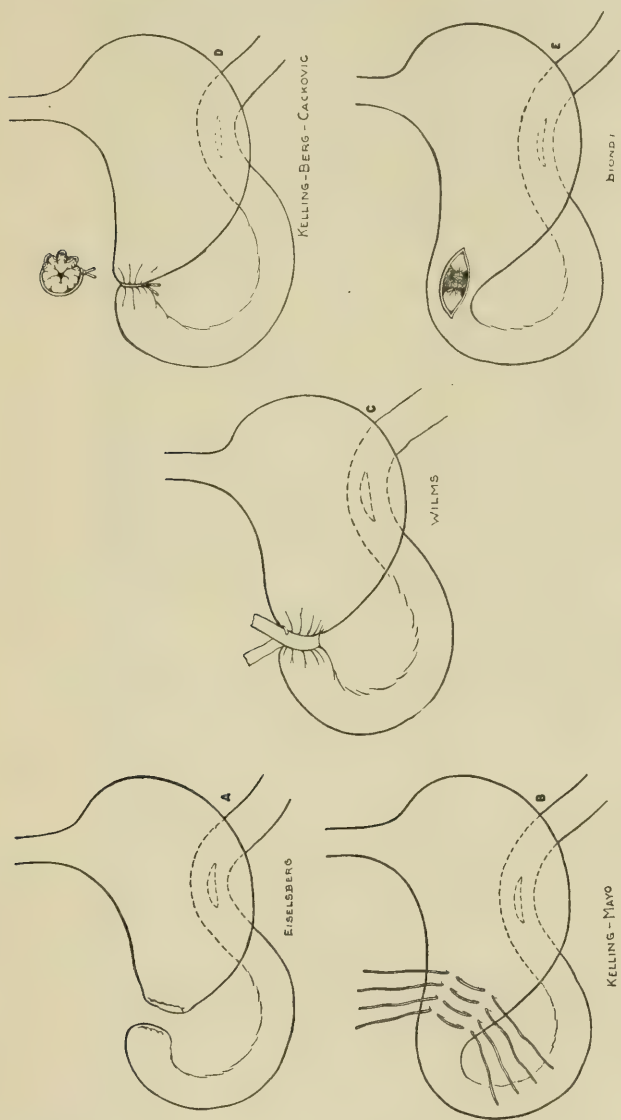


FIG. 31.—Lewisohn's classification of the methods for pyloric exclusion: A, von Eiselsberg method of pyloric exclusion; B, Kelling-Mayo method of pyloric exclusion; C, Wilms method of pyloric exclusion; D, Kelling-Berg-Cackovic method of pyloric exclusion; E, Biondi method of pyloric exclusion.

pyloric exclusion is likewise unsuccessful after crushing the pylorus or after the application of irritants to the pyloric mucosa. He believes that much of the experimental evidence adduced as proof of pyloric

¹ Annals of Surgery, April, 1916, p. 438.

exclusion by fascial bands is incorrect, because observations have been made too soon after operation.

Recurrence after exclusion of the pylorus was also noted by Gramen.¹

In a recent review of the subject, Lewisohn² enumerates the various classical methods (Fig. 31). Lewisohn has devised a modification of the Biondi method. It will be remembered that the Biondi method consists in longitudinal incision through the serosa and muscularis of the pylorus, the musculoserous coat being peeled away from the mucosa. A mucosal tube thus being freed, is ligated and cut between two ligatures and the stumps are carbolized (Fig. 31, *E*). The seromuscular coat is then closed with a few sutures. Lewisohn's modification of the method consists in freeing the pyloric region from the gastro-hepatic omentum and making a circular *transverse* incision down to the mucosa (Fig. 32). The tube of mucosa is freed and divided between



FIG. 32.—Modified Biondi method showing incision of serosa and muscularis. (Lewisohn.)

ligatures (Fig. 33). The stumps are carbolized and are then buried by suture of the duodenal and stomach ends respectively (Fig. 34). Lewisohn performed the operation on 5 dogs. Two dogs died shortly after the operation. The 3 surviving dogs (observed thirty-eight, sixty, and one hundred and fifty-four days after operation) all showed a permanent and absolute occlusion of the pylorus.

As regards the late results in the Kelling-Berg-Cackovic method of pyloric exclusion with a Pagenstecher linen suture in man (Fig. 31, *D*), Lewisohn had occasion to resect such a pylorus twenty months after exclusion according to this method. The specimen showed the stitch on the anterior surface of the pylorus, the knot distinctly visible and intact. The mucous membrane did not seem to be atrophic on macroscopic examination. The pylorus was patent, admitting the little finger.

¹ Zentralbl. f. Chir., 1916, p. 853.

² Surgery, Gynecology and Obstetrics, April, 1916, p. 379.

Lewisohn believes, that with the exception of Eiselsberg's unilateral exclusion and his own modified Biondi method, none of the different methods of exclusion guarantees a permanent occlusion of the pylorus. These

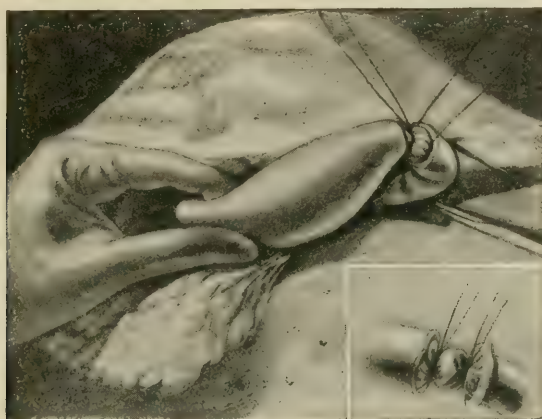


FIG. 33.—Modified Biondi method showing ligation of mucous membrane. (Lewisohn.)

two methods, however, are technically complicated. Lewisohn considers the clinical results are just as good after the simpler methods which afford temporary exclusion as after the more complicated methods, such as the Eiselsberg or modified Biondi. Of the various constriction methods,

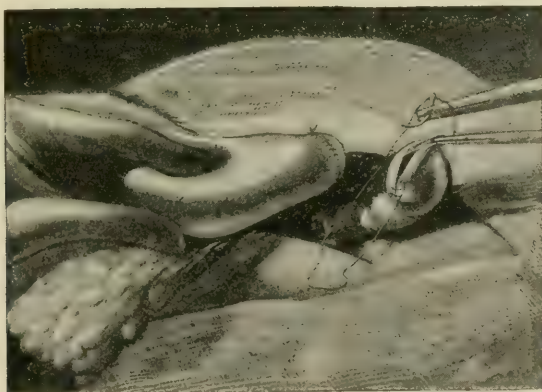


FIG. 34.—Modified Biondi method showing the burying of the stumps. (Lewisohn.)

he believes the exclusion stitch (Kelling-Berg-Cackovic method) is as effective and much less complicated than the methods of Wilms, Parlavacchio or Biondi.

Independently of Lewisohn, R. A. Barr¹ has also evolved a modified

¹ Surgery, Gynecology and Obstetrics, July, 1916, p. 23.

Biondi technic (Figs. 35 and 39). After freeing a cylinder of mucous membrane, a clamp or two clamps are applied transversely. The mucous membrane is then sutured on both sides of the clamps by chain ligatures of linen. The clamp is then removed and the mucous membrane divided in

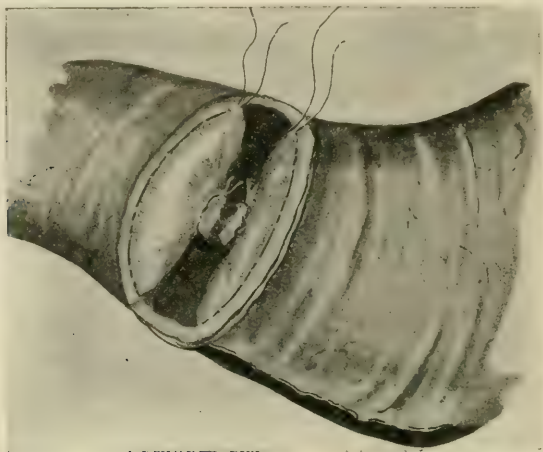


FIG. 35.—A purse-string suture of catgut or linen is thrown around the base of each stump. (Barr.)

the groove left by it. A purse-string of catgut or linen is thrown around the base of each stump (Fig. 35). The stumps are inverted and the purse-string tightened. When the weakness of the stomach makes a purse-string undesirable, a continuous suture approximates the anterior and

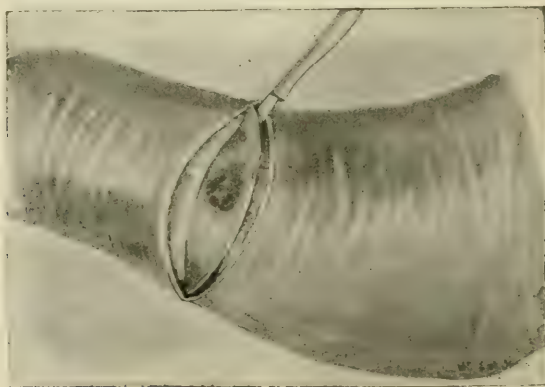


FIG. 36.—Method of resecting an ulcer of suitable size on the anterior wall. (Barr.)

posterior walls. The seromuscular tissues are then closed, the edges of the wound being inverted so as to bring the peritoneum in contact with the muscle of the posterior stomach wall. A similar technic may be used for excising an ulcer of the anterior wall (Fig. 36).

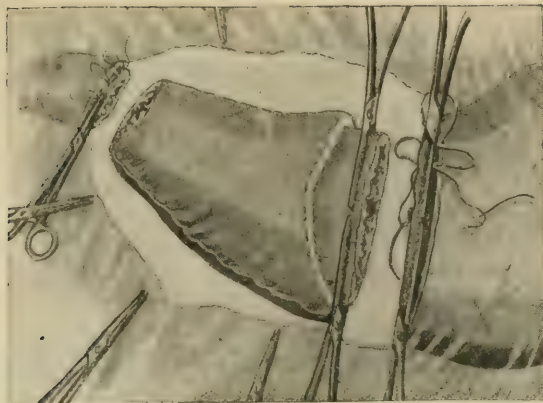


FIG. 37.—Showing technic used in pyloroplasty. (Barr.)

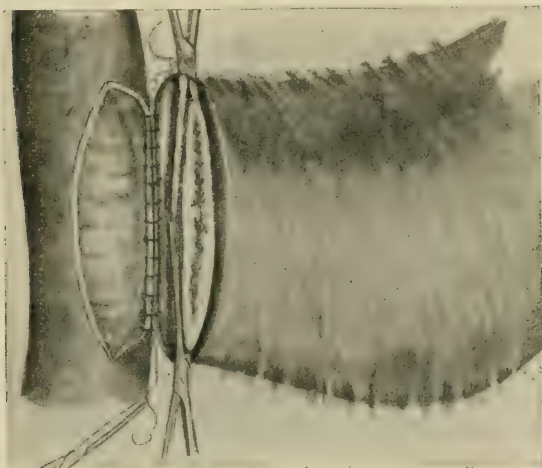


FIG. 38.—Cavity of stomach held closed by clamps on mucous membrane until posterior seromuscular suture line is completed in gastrojejunostomy. (Barr.)

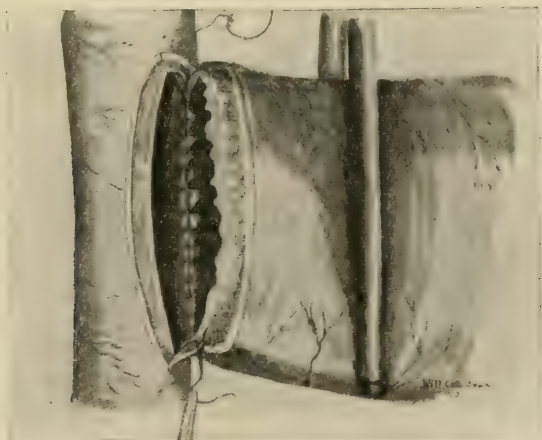


FIG. 39.—Posterior seromuscular suture line completed and rubber-covered clamps in place. (Barr.)

The accompanying illustrations show Barr's application of this detail of technic to pylorectomy (Fig. 37) and to the Polya operation (Figs. 38 and 39).

The steps of the Polya operation, as described by Barr, do not materially differ from those of W. J. Mayo,¹ except that Mayo clamps all the walls of the stomach, whereas Barr clamps merely the mucous membrane. In this latter instance I doubt whether the difference in technic is of great moment.

Resection of Duodenum for Ulcer. Deaver² says: "When excision of a gastric ulcer has not materially interfered with the mechanics of the stomach (with the exception of pyloric ulcer) posterior gastro-enterostomy should not be done." He believes that all ulcers of the stomach or duodenum are best treated by excision. When there is strong clinical probability of gastric ulcer supported by positive x-ray evidence, and when palpation and inspection are doubtful, Deaver does not hesitate to open the stomach in order to settle the matter by inspection of the mucosa. No ulcer, however, should be excised when subsequent closure and anastomosis present too great operative hazard. Under such conditions, he relies upon a gastro-enterostomy. Elsewhere he³ advocates excision of the ulcer whenever possible. In the last 40 cases, among which there were many pylorectomies, he had no fatalities. Most ulcers of the duodenum are situated on the anterior surface of the first portion, and, when the induration is not too pronounced, the ulcer should be excised. When induration is considerable, amputation of the duodenum and posterior gastro-enterostomy, in other words, pylorectomy, are indicated. Lavage is one of the most important considerations in the after-treatment of these cases.

Haberer⁴ is of the same opinion. He resects the duodenum for ulcer. He does not believe that gastro-enterostomy is of value in the treatment of ulcer in cases where there is no marked stenosis of the pylorus or duodenum. When it would be technically difficult to extirpate such a diseased area of the duodenum on account of extensive adhesion, etc., Haberer recommends the unilateral Eiselsberg exclusion. He considers that the resection of the upper portion of the duodenum, which is alone permissible, should be performed only after one has made sure that it can be made without injury to the pancreatic or common bile ducts. Adhesion and perforation of any ulcer into the head of the pancreas are in themselves no contra-indication to resection. Not only is the resection of the uppermost part of the duodenum a perfectly feasible operation, but it is indicated when one is not sure of the benign character of the tumor, and, according to Haberer, is indicated in all cases of threatened perforation of the anterior wall of the duodenum.

Gastrojejunal Ulcer. Ginsburg⁵ reports a jejunal ulcer following gastro-enterostomy with absolute closure of the stoma, discovered by radiological examination and later confirmed by operative exploration.

¹ See PROGRESSIVE MEDICINE, June, 1915, p. 113, Fig. 32.

² Annals of Surgery, September, 1916, p. 294.

³ Journal of American Medical Association, vol. lxvii, p. 858.

⁴ Wien. klin. Wchnschr., 1916, No. 29.

⁵ Annals of Surgery, June, 1916, p. 732.

There was a coexistent large jejunal ulcer at the duodenojejunal angle. No shreds of suture material were found in the ulcer. Ginsburg says, "Since no cases of gastrojejunal or jejunal ulcer have been proved to follow Finney's pyloroplasty, this operation should have the first place, when it is indicated, in the treatment of pyloric ulcer. The posterior no-loop gastrojejunostomy, as performed in this country, has shown fewer ulcers than any other operation except Finney's. Theoretically, the performance of gastro-enterostomy without clamps (thereby avoiding trauma) possesses more safety than the operations in which clamps are employed. A large opening and either permanent or temporary blockade¹ are of much importance in safeguarding against the development of ulcer at the stoma. At the present time the question of duodenal closure by ligation or exclusion, according to von Eiselsberg, is still a debatable question if one may judge by the present literature upon the subject."



FIG. 40.—Bryan's case of perforating jejunal ulcer. Stomach shows great thickening, walls white and heavy, organ markedly contracted and bound down to the left of the median line.

Perforation at the stoma two years after gastrojejunostomy for duodenal ulcer was reported by Ross and Swartley.² No suture material was found at the site of perforation.

In a recent discussion, Coffey³ said: "Secondary ulcer is caused by linen suture at the base of the ulcer in 3 out of 4 cases, but the ulcers have extended two or three inches away from the suture, and, in one case where catgut was used, we had an ulcer of the same kind. Curiously enough, the four ulcers occurred in two patients, and the ulcer recurred after the second removal in spite of the fact that catgut was used throughout the second time."

¹ See Pyloric Exclusion above.

² *Annals of Surgery*, September, 1916, p. 375.

³ *Journal of American Medical Association*, vol. lxvii, p. 858.

ULCER OF THE JEJUNUM IN THE ABSENCE OF A PREVIOUS GASTRO-ENTEROSTOMY is a condition of great rarity. Bryan, of Richmond,¹ reports the case of a man, aged forty-eight years, apparently suffering from an acute perforation of the stomach. The peritoneal cavity was filled with greenish fluid containing flakes of lymph and food particles.



FIG. 41.—Jejunum greatly indurated, the mesentery shrunken, its walls white and hard. Perforation shows about three inches from the duodenojejunal juncture. (Bryan.)

The stomach was atrophic, hard, bound down, pulled to the left, and firm (Fig. 40). The walls were white and heavy, the omentum shrunken and thickened. The duodenum was indurated and the jejunal wall was likewise indurated, whitish, and thickened, and there was a perforation on its anterior wall about three inches beyond the duodenojejunal

¹ Surgery, Gynecology and Obstetrics, March, 1916, p. 279.

juncture (Fig. 41). The induration of the jejunum extended for several inches beyond the point of perforation and gradually faded away.

In addition to his own case, Bryan refers to 3 cases reported by Van Roojen of jejunal ulcer in the absence of previous gastro-enterostomy.

The Comparative Effect of the Actual Cautery as Compared to the Scalpel in Wounds of the Stomach. The healing of wounds made by the actual cautery in the stomach wall was made the subject of experimental investigation by Scudder and Harvey.¹ Their experiments were done on dogs. As a result, they determined that suture of the cauterized margins of the stomach wall is attended by practically a normal reparative process similar to the reparative process following simple excision with the knife. They believe this method is safe for ordinary use in the human being, and they suggest excision of the ulcer from the center outward, as suggested by Balfour, as well as the cauterization of the edges and base of ulcers on the posterior wall of the stomach which must be reached through an anterior gastrotomy, even in those ulcers which are adherent to the posterior parietes and pancreas. This work is confirmatory.

Operative Injuries to the Colica Media Artery have been mentioned in previous views. Urrutia² accidentally injured the vessel in resecting a cancer of the pylorus in a man, of thirty-five. He ligated both stumps of the injured artery and observed no disturbance of any kind following it.

A Time-saving Measure in Making an Entero-anastomosis after Anterior Gastro-enterostomy is suggested by Frank Matthews³ in conjunction with cases in which posterior no-loop operations are not feasible. In each instance, before closing the circle of sutures in the gastro-enterostomy, Matthews loosens the clamp on the jejunum and drops one-half of a Murphy button into each segment of the gut. After concluding the gastro-enterostomy suture, an entero-anastomosis is made by simply snapping the halves of the Murphy button together after making a small cut in each wall of the gut. This adds but a couple of minutes to the operation and surely avoids the possibility of vicious circle from duodenal distention. Matthews does not advise routine anterior gastro-enterostomy.

Acute Operative Dilatation of the Stomach. Lee's⁴ patient was a longshoreman, aged thirty-one years, upon whom a posterior no-loop gastrostomy had been performed for a stenosis due to duodenal ulcer. As closure of the abdomen was begun, the intestines began to be pushed out through the abdominal wound, suggesting that the patient was coming out of the anesthesia. More ether was requested by the surgeon. This bulging of the abdominal viscera, made the closure of the peritoneal cavity difficult. No suspicion was entertained at the moment that an acute dilatation of the stomach was the cause of the intestinal protrusion, and so time was taken to close the abdomen with layer

¹ Surgery, Gynecology and Obstetrics, December, 1916, p. 719.

² Siglo Medico, Madrid, July 8, 1916, abstracted in Journal of American Medical Association, vol. lxxvii, p. 709.

³ Annals of Surgery, September, 1916, p. 363.

⁴ Ibid., April, 1916, p. 418.

sutures. As the final stitches were being placed, it became apparent that the patient was in a desperate condition, and he was dead a moment later. Artificial respiration was performed for ten minutes and an effort was made to massage the heart through the abdominal wound, which had been hastily reopened. At autopsy, the stomach was found enormously dilated and partly filled with a very thin fluid and gas. The duodenum was markedly dilated, the distention coming to a sudden stop where the mesentery crossed the gut.

Lee was able to collect 5 other cases of sudden, extreme dilatation of the stomach in anesthetized patients. Some of these cases have been cited in previous reviews.¹ In addition to these cases, Lee appends an exhaustive view of the entire subject of postoperative dilatation of the stomach with citation of the various theories advanced to explain the condition. The reviewer cannot help feeling that a distinction should be made between sudden, enormous dilatation of the stomach in patients who are taking an anesthetic badly (as reported in most of the case histories) and the acute dilatation of the stomach apparent in cases from one to four days after operation.²

In the experiment of introducing ether into the peritoneal cavity, Cubbins and Abt say it is impossible to keep fluid ether among the warm intestines of an animal because ether vaporizes at 88° F. In a semi-conscious patient who is struggling and going through swallowing motions, it is not difficult to imagine that the anesthetist, usually an interne of not extended experience, in his attempts to get the patient under at the urgent request of the operator, will pour out an overgenerous amount of the anesthetic, either ether or chloroform, and some of it may be inadvertently swallowed by the patient. Certainly, if air swallowing were the actual cause of the condition, as suggested by certain authors, the swallowing would have to be carried on with the rapidity and vigor of a person inflating a bicycle tire in order to accomplish the enormous progressive dilatation as described in the accounts published. On the other hand, if toxic factors or nervous factors were at work, a single emptying of the stomach by passage of the tube ought not to have the permanent curative effect reported in most of the cases. The tendency to dilatation should continue, perhaps to a less marked degree, but, nevertheless, it ought to be manifest, and this has not been so in the cases observed to acutely dilate on the operating table under the eye of the surgeon. On the other hand, repeated lavage of the stomach has been necessary in the postoperative dilatations of the stomach which, as pointed out by competent observers, may be classified according to several different etiological factors (paralysis, arteriomesenteric ileus of Haaberer, enormous dilatation of the stomach produced in dogs by an experimental division of the vagus and the splanchnic, etc.).

In many of the postoperative cases, only prolonged, systematic, repeated emptying of the stomach has been effective in controlling the condition.

¹ *PROGRESSIVE MEDICINE*, June, 1914, p. 61; June, 1916, p. 108.

² See previous reviews of this condition in *PROGRESSIVE MEDICINE*, June, 1911, pp. 101-105; June, 1914, p. 90.

Hour-glass Stomach due to Syphilitic Involvement. Culler¹ found at laparotomy a prepyloric hour-glass contraction, very hard and dense

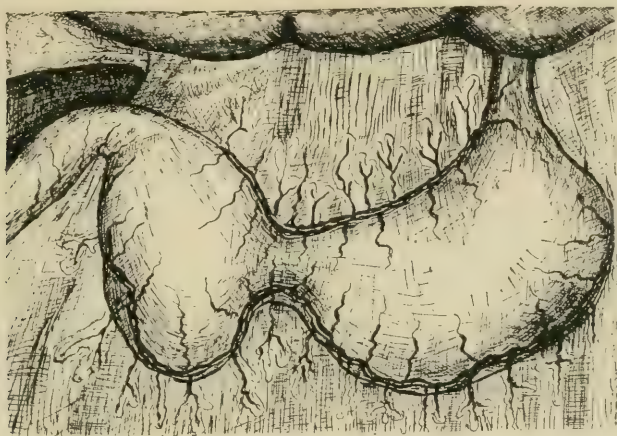


FIG. 42.—Syphilitic hour-glass stomach—appearance *in situ*. (Culler.)

(Fig. 43). There was fibrous infiltration of the greater curvature of the cardiac pouch. The stomach wall of the pyloric pouch was normal. A Riedel transverse (segmental) resection of the stomach wall, including

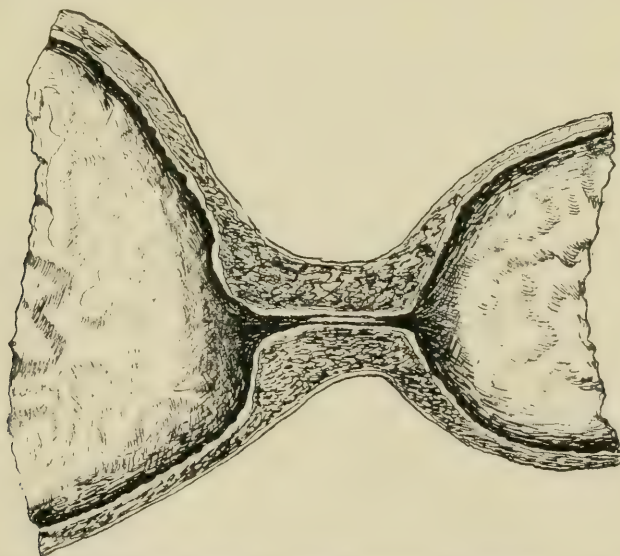


FIG. 43.—Longitudinal section of excised portion of stomach. (Culler.)

the involved strictured portion, was performed. Fig. 42 shows the condition at operation and Fig. 43, a drawing of the resected

¹ Journal of American Medical Association, vol. lxxvii, p. 1667.

specimen. There was a dense fibrous stricture, which, after removal, hardly permitted the passage of a grooved director. There was no ulceration, but the mucous membrane was glazed and thin, suggesting recent healing.

Hernia of the Lesser Curvature of the Stomach. Brown¹ reports the case of a woman, aged twenty-nine years, with a history suggestive of ulcer of the stomach for fifteen years. X-ray examination showed a picture strongly suggestive of penetrating ulcer of the lesser curvature. At operation, no external signs of ulcer could be found. On the lesser curvature, a small outpouching of the stomach wall was found, corresponding to the deformity shown in the x-ray plate. This was the size of an English walnut, and resembled a hernia-like weakening of the stomach wall. No evidence of ulcer was seen near this pouch. A trans-gastric incision was made into the stomach and the interior carefully explored. No ulcer or growth found. Duodenum negative. Incision in the stomach was closed. The hernia on the lesser curvature was plicated with three linen sutures. The patient made an uneventful, rapid recovery.

SMALL INTESTINE.

Intestinal Obstruction has formed the subject of a number of important papers during the past year. Some are reports of experimental work and others are clinical.

EXPERIMENTAL. Sweet, Peet and Hendrix² state that the symptoms of acute pancreatitis and of acute high obstruction are so alike that a differential diagnosis can only be made at operation.

They mention the fact that up to the present time it has not been possible to demonstrate any toxin from stasis of the large intestine (Frazier, Peet and Strauss.) The old experiment of Halsted shows that chronic ileac stasis can be indefinitely borne. Sweet, Peet and Hendrix suggest that perhaps attention has been directed to the wrong end of the alimentary canal in these cases of so-called stasis. They point out that ptosis of the colon will certainly drag the transverse duodenum across the head of the pancreas, and indeed a dilated duodenum has often been reported in these cases. The removal of the colon would relieve this drag. In other words, given a demonstration of a toxin of great potentiality (less than one-tenth of a dram of this proteose will kill a fifteen-pound dog in a few hours), would it not be well for the clinician to consider the possibilities of a chronic absorption of such a product from the upper end of the alimentary tract?

In a series of clear illustrations, they briefly review the experimental work done on high intestinal stasis. Fig 45 shows the Draper twine triangular stitch which was intended to take the place of the McGraw elastic ligature for cutting through a gastro-enterostomy. With this plan all animals died before seventy-two hours—the time which was necessary for the twine to cut a stoma between the stomach and bowel.

¹ Journal of American Medical Association, vol. lxvi, p. 1918.

² Annals of Surgery, June, 1916, p. 720.

On the other hand, animals operated according to Fig. 45 lived as well as those operated on as in Fig. 46.

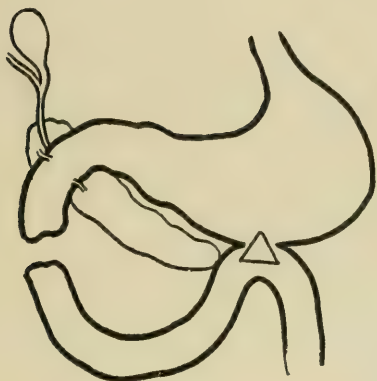


FIG. 44.—Draper's twine triangular stitch. Animal died before seventy-two hours elapsed, the time necessary for stitch to cut through.

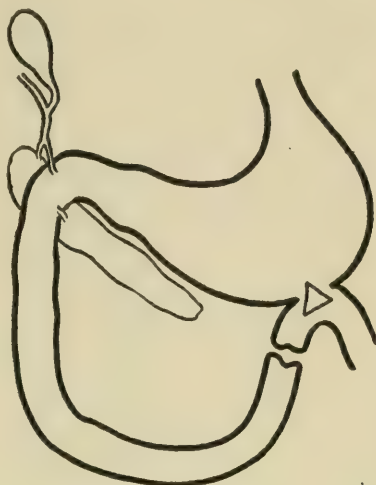


FIG. 45.—Another Draper modification. Animals operated according to this plan lived, provided the blind loop was longer than 35 cm.



FIG. 46.—Animals operated according to this scheme lived. If the blind end of the duodenum was longer than 35 cm. from the pylorus the animal lived, whereas if it was less than 35 cm. the animal died. (Draper.)



FIG. 47.—Modification of Draper's method. The isolated loop contains a powerful poison which, free from bacteria, will cause the death upon injection into a normal animal with typical symptoms of high obstruction. (Whipple, Stone and Bernheim.)

Fig. 47 shows Whipple, Stone and Bernheim's modification of Draper's method.

Does a gastro-enterostomy functionate in the presence of a normal pylorus? Fig. 48 shows the work of Draper, in which a string attached to a bolus of food had followed a normal course.

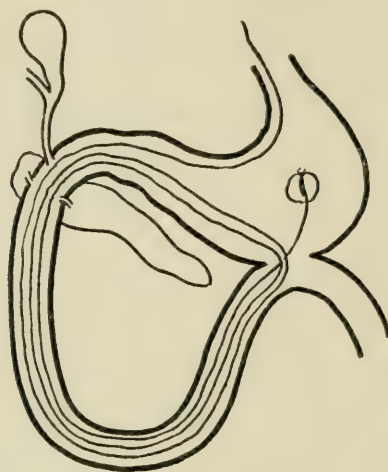


FIG. 48.—Draper's experiment: a string attached to a bolus of food has followed the normal course.

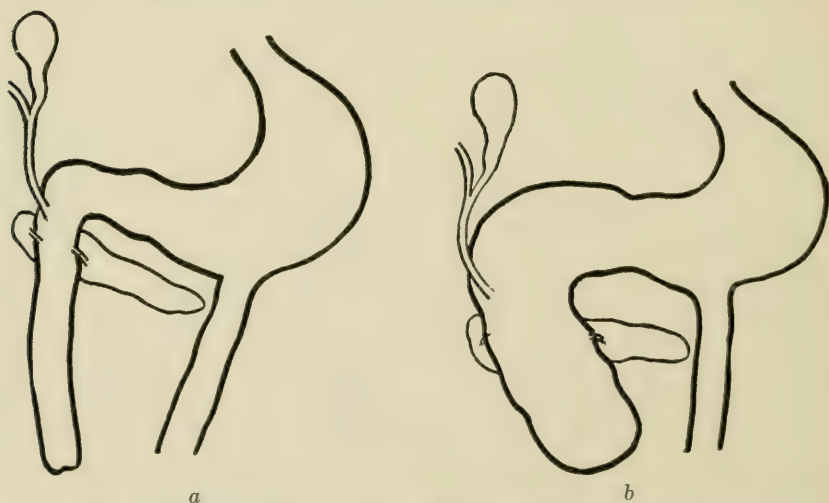


FIG. 49.—These animals died, while those who survived the same operation (Fig. 49*a*) showed (Fig. 49*b*) an enormous dilatation of the duodenum. (Sweet, Peet and Hendrix.)

Figs. 49*a* and 49*b* illustrate Sweet, Peet and Hendrix's experiment. In this the animals which died, showed symptoms of high intestinal obstruction; in those which lived (Fig. 49*b*) there was an enormous dilatation of the duodenum.

Fig. 50 shows Whipple, Stone and Bernheim's experiment. Death followed even though the isolated loop was drained to the outside, and even though it was washed out freely. Sweet and his co-workers explain the result as caused by a functional obstruction of the gut.

Fig. 51 (Sweet, Peet and Hendrix) depicts an isolation of loop of upper bowel, with restoration of continuity of the gut. The animals lived even though the loop was closed at both ends for weeks. The loop became enormously distended with fluid. Likewise, isolation of a loop from below the ileum will permit continued life of the animal for long periods. However, if such a low loop is filled with pancreatic juice or with a dog's fresh pancreas, the animal may die, with symptoms characteristic of high obstruction.

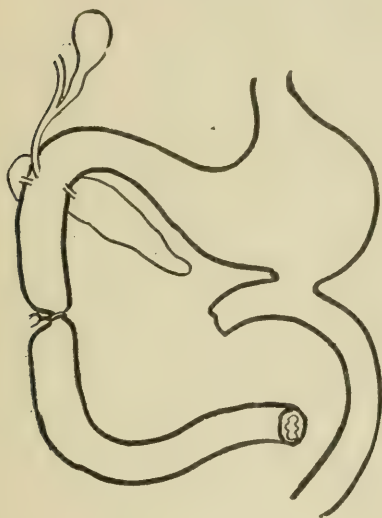


FIG. 50.—Death followed this even when the isolated loop was drained to the outside. (Whipple, Stone and Bernheim.)

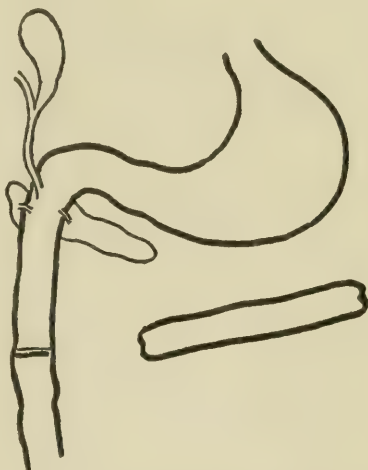


FIG. 51.—Isolation of loop of upper bowel and restoration of intestinal continuity; the animals lived. (Sweet, Peet and Hendrix.)

The appended chart (Fig. 52) shows the toxic products of proteid digestion.

Sweet, Peet and Hendrix have fairly well proved firstly (Fig. 49), that a gastro-enterostomy opening does not function in the presence of a normal pylorus; secondly, the similarity between acute pancreatitis and acute high obstruction, which shows they are alike because they both are essentially the same thing, namely, an intoxication with the toxic product of protein cleavage, in pancreatitis certainly due to the proteolytic ferments of the pancreas in high obstruction, in all probability, the same toxic product due to the same ferment.

They state that in pancreatitis, the escape of products of the digestion of the pancreas into the tissues causes the intoxication; in obstruction, the conditions present give rise to absorption of toxic substances,

which, under normal conditions, would either not be formed or, if formed, would immediately be broken down into non-toxic substances.

Whipple's¹ findings are similar to those of Sweet, Peet and Hendrix. He holds that the intoxication which develops in intestinal obstruction, general peritonitis, and acute hemorrhagic pancreatitis is due to a primary proteose. Whipple finds that it is comparatively easy to isolate the poison from closed loops of the intestine. The proteose is extremely toxic, so that 100 mgs. may suffice to fatally poison a fifteen-pound dog.

In speaking of his experimental work, Whipple says: "It may be objected that when a toxic proteose is isolated from a closed loop of intestine, this substance is not actually concerned in the intoxication.

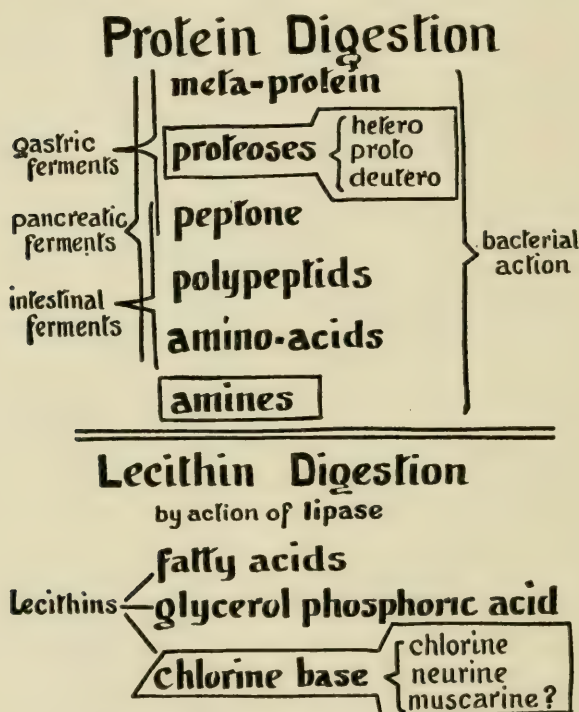


FIG. 52.—Chart to illustrate toxic products of protein digestion.

For example, it cannot be demonstrated in the blood, but when a toxic proteose is isolated from the exudate of a general peritonitis, no valid reason can be given why the substance is not concerned in the associated intoxication. Absorption from the peritoneal cavity is known to be very rapid, and any soluble substance like a proteose will be absorbed into the blood stream with alacrity. We can show that a peritoneal exudate contains a toxic proteose which closely resembles the proteose isolated from closed intestinal loops. It gives the same biological reaction when injected into animals. Further, it can be shown that this proteose is

¹ Journal of American Medical Association, vol. lxxvii, p. 15.

not due to bacterial activity, as the toxic proteose can be demonstrated in a sterile peritonitis caused by turpentine, aleuronat, or bile. It seems safe to assume, therefore, that the proteose must be derived from the proteins of the host. In a general peritonitis due to bacteria the same proteose can be isolated, and it is logical to suppose that here, too, the proteose may be derived from the tissues or tissue proteins of the host.

A sterile, hemorrhagic pancreatitis may be produced by the injection of bile into the pancreatic duct. The clinical picture of intoxication under these conditions is familiar. It is very like that of acute intestinal obstruction. During the first twenty-four hours after operation the animal may be killed, the pancreas rapidly ground up in water, the mixture centrifuged, and the supernatant fluid poured into five volumes of 94 per cent. alcohol. This precipitate contains much albumin, which can be removed by heat in a faintly acid solution. The slightly opalescent filtrate can be concentrated and tested in animals to show the presence of a toxic proteose. The amount of proteose here is not great as compared with the amount in an intestinal obstruction, but this difference may be due to the great difference in the rapidity of absorption. It is possible that the proteose is absorbed from the pancreas almost as rapidly as it is formed. Jobling has brought indirect evidence to show there is a proteose intoxication in acute pancreatitis.

Considerable data have been recently published which show a rise in non-coagulable nitrogen of the blood in many conditions of intoxication, notably in acute intestinal obstruction. The non-coagulable nitrogen may rise from 25 mgs. per 100 c.c. to 100 or even 200 mgs. There is no lack of eliminative power in the kidneys to account for this. Acute proteose intoxication due to the injection of a pure proteose into a normal dog may show a rise of from 25 mgs. per 100 c.c. of blood to 40 to 60 mgs., within three or four hours. A similar rise in blood non-coagulable nitrogen may be found, in general peritonitis whether septic or sterile, and acute hemorrhagic pancreatitis.

Experiments have been carried out to explain the rise in non-coagulable blood nitrogen in intestinal obstruction, general peritonitis, acute hemorrhagic pancreatitis, and also in pleurisy and abscess formation. (Cooke, Stearns and Whipple, unpublished).

Dogs kept in metabolism cages after four or five days, show a constant urinary nitrogen elimination for twenty-four hours. If a small dose of pure proteose is given intravenously, there will be a great increase in the urinary nitrogen elimination. This nitrogen must be derived from the tissues of the animal, and it is to be emphasized that the katabolism in increased elimination lasts for days. The rapid rise in non-coagulable nitrogen may last only a few hours following the injection, and is usually best seen in fatal cases in which the tissue destruction is extreme; but all the evidence points to katabolism of the host's tissues due to the proteose intoxication as explaining the high non-protein nitrogen of the blood. A certain type of simple duodenal obstruction may be produced with which there is little or no vomiting and no dehydration, and yet in such animals there will be a 200 per cent. increase in urinary nitrogen elimination per twenty-four hours, and death in six to eight days, with a blood non-coagulable nitrogen well over 100 mgs. per 100 c.c. of blood.

Similar increase in the urinary nitrogen excretion has been found in experimental pancreatitis, peritonitis, pleurisy, or sterile abscess. Whipple and his co-workers assume that the injury of the local tissues give rise to a toxic proteose which is absorbed into the blood and injures the entire organism, causing, among other things, a considerable destruction of tissue protein in all parts of the body and the resulting increase in blood non-coagulable nitrogen followed by a great rise in urinary nitrogen.

These different toxic proteoses isolated from the intestine, peritoneum, and pancreas have certain biological reactions in common, but give no specific reactions by which they can be differentiated. They give no anaphylactic reactions in guinea-pigs, no precipitins, and no complement-fixation. It has been shown that the blood of dogs repeatedly injected with proteose cannot destroy the toxic proteoses, whereas the tissues of such animals can rapidly destroy such proteoses *in vitro*.

This proteose concerned in the intoxication of intestinal obstruction is resistant to digestion by the intestinal mucosa and by the pancreatic and tissue ferments. Whipple and his co-workers have not yet determined whether the toxic proteoses concerned in hemorrhagic pancreatitis and general peritonitis possess the same resistance to digestive enzymes.

Any animal injected with one proteose becomes resistant not only to this proteose but also to other proteoses. For example, proteose from human material when injected into a dog will give tolerance to any of the proteoses obtained from the intestines or peritoneum of the dog or cat. This holds for all proteoses tested by them.

Dogs with long-continued obstruction or closed intestinal loops, will survive lethal doses of pure proteose with but few clinical symptoms of intoxication. Dogs recovering from a sterile pleurisy or peritonitis also show a definite resistance or tolerance to subsequent proteose injections. All this evidence strengthens the argument that a proteose intoxication is present in the various conditions.

Other conditions in which inflammation, pus formation, or tissue destruction are conspicuous may be considered in which it is possible that toxic proteosis may be concerned. Whipple and his co-workers have made experiments with sterile pleurisy considered as identical with peritonitis and with sterile abscess formation, but do not care to report their findings at present. Infarct, pneumonia, and many other conditions are interesting possibilities which are being investigated. Whipple feels convinced that proteose intoxication is the most important factor in the general intoxication noted in conditions of intestinal obstruction, general peritonitis, and acute hemorrhagic pancreatitis. This evidence adduced by Whipple goes hand in hand with the clinical observation of profound prostration accompanying the twist of an ovarian cyst, with a little clear sterile exudate, but no macroscopic peritonitis at the time of operation.

A Human Case with Intestinal Obstruction (Whipple, Cooke and Rodenbaugh)¹ showed the same blood findings as those in *Animal Experi-*

¹ Journal of Experimental Medicine, June, 1916, p. 717.

ments. The kidneys were normal. According to Whipple and his co-workers, transfusions of dextrose solutions often benefit intestinal obstruction, and may depress the level of the non-coagulable nitrogen of the blood. Some cases show no changes in non-coagulable nitrogen after transfusions and diuresis, and, as a rule, these cases present the most severe intoxication. Although most cases show a high percentage of non-coagulable nitrogen with severe intoxication, a low reading may be present with a fatal outcome.

The cause of death in acute experimental pancreatitis was also studied by Petersen, Jobling and Eggstein;¹ these authors believe that death is caused by the sudden flooding of the blood stream with the split products formed at the expense of the pancreatic tissue, of which the proteose increase is an index. In other words, death is due to an intoxication from protein-split products and not to an intoxication from pure tryptic ferment. Increase in serum antiferments apparently favors recovery.

In this connection, recent investigations concerning the *Role of the Omentum in Drainage of the Peritoneal Cavity* are of much interest.

Shipley and Cunningham,² of Baltimore, found that kidneys of animals killed three hours after immersion of the omentum in citrate cyanide solution when fixed in acid formalin showed a deep blue color microscopically in the papillae and cortex, due to precipitation of Prussian blue by the acid.

Experiments with trypan blue were especially striking, and one hour's exposure of the omentum to a 1 per cent. solution of the dye, caused a perceptible staining of the animal's skin and mucous membranes. This proof of drainage of matter from the serous cavities *via* the blood stream is extraordinary and was unexpected, since the bloodvessel wall had not hitherto been credited with permitting the passage of anything but fluid, with the possible exception of the capillaries of the intestinal mucosa. It is probable that only very small granules of ink pass into the omental veins. Microscopic sections of the livers of these animals showed that some ink underwent phagocytosis by the capillary endothelium, but in most it was found as free granules in the lumen of bloodvessels. A considerable amount of granular material must leave the cavity of the peritoneum through the omental veins. In none of the sections or the numerous span preparations did Shipley and Cunningham find lymphatic vessels in the omentum of any animal, and sections showed clearly, that even if such vessels exist, omental lymphatics have no important role in the drainage of the peritoneal cavity. On the other hand, the omentum itself through its vessels plays a very large part in the actual drainage of the peritoneal cavity.

CLINICAL POSTOPERATIVE INTESTINAL OBSTRUCTION. Of 34 operations performed for intestinal obstruction Gibson,³ reports that 70 per cent. were due to the sequelae of previous operations. He found that one-third of the fatal cases in obstruction by band were due to an overlooked,

¹ Journal of Experimental Medicine, 1916, p. 491.

² American Journal of Physiology, March, 1916.

³ Annals of Surgery, April, 1916, p. 442.

unrelieved obstruction. Like others, he advocates an entero-anastomosis of loops entering and leaving a matted-together, tangled area at some part of which there is an obstruction. In doubtful cases, Gibson advocates *the giving of powdered charcoal followed by a brisk cathartic*. If the charcoal comes through within a few hours, it is a convincing demonstration that at least a complete exclusion does not exist. However, he cites the case of a patient with intestinal obstruction to whom a half-ounce of charcoal was given. Next day the stool was covered with charcoal. Symptoms recurred, and although charcoal was given a second time, it did not come through. At operation, an obstruction was found from adhesions of the cecum to the mesentery of the ileum.

In the *treatment of paralytic ileus*, Gibson considers *pituitrin* a veritable life-saver. He says: "All previous forms of intestinal excitants had failed me in grave cases, including eserine, the deadly hormonal, intravenously, and even the unjustifiable croton oil. Enterostomy although giving an occasional success to an occasional operator, has never seemed to me of value in treating paralytic ileus, and certainly has never been successfully employed by me. Admitting, for the sake of argument, that enterostomy may rarely overcome a paralytic ileus, I feel very strongly that it should not be resorted to until a trial with pituitrin has been made."

As to the particular preparation, Gibson says he is not familiar with the comparative merits of the various preparations on the market. It is given intramuscularly in doses of 1 c.c. repeated every hour up to three doses, subsequent doses two hours apart. He has never given more than five doses in twenty-four hours. For cases of a milder variety, the second injection usually brings about the passage of gas in considerable quantities, and often results in a spontaneous stool. The effect may, of course, be reinforced by a suitable enema. He has not employed pituitrin intravenously. In one of his cases, the whole dose was apparently accidentally injected into a vein. This was immediately followed by a profound collapse endangering the patient's life, but she subsequently recovered not only from the collapse but also from the obstruction.

In the discussion which followed the presentation of Gibson's paper, Collins also reported favorable results from using pituitrin in post-operative ileus. Each time the pituitrin was administered there was a discharge of gas, but the intestine in between these periods became paralyzed. As time went on, the response to pituitrin steadily decreased until it took almost an hour before there was any result. The patient had a paralytic ileus, from which he died on the eighth day, although, upon reopening the abdomen, there was no peritonitis.

Stevenson, Shaw and Mackenzie,¹ in reporting their experiences with laparotomies performed in field hospitals, said that pituitrin was given hypodermically almost immediately after operation. They consider it a most valuable drug in the after-treatment of abdominal cases. The administration of morphine seems to have no hindering effect upon the action of pituitrin.

¹ Lancet, July 19, 1916, p. 173.

It was found that if patients were allowed to chew gum, this afforded them much alleviation of hunger and thirst.

Two recent experimental investigations regarding the action of pituitrin should be borne in mind in view of the favorable reports from the bedside which have just been given above.

R. G. Hoskins¹ quotes the observation made by Schamoff, that instead of the usual stimulation, a marked depression was observed in the action of pituitary extract upon isolated segments of rabbit intestine. This was contrary to the commonly held view that such extracts directly stimulate smooth muscle. Hoskins investigated the effect of intravenous injections of pituitary extract on the intact and isolated small intestine of dogs. In 5 cases out of 6, a clean-cut depression of tone and peristalsis occurred. Commercial pituitrin was the extract used. Hoskins says: "In view of the frequent use of such extracts clinically as peristaltic stimulants, this depressive effect should be recognized. This inconstancy of behavior should be further investigated. The possibility is suggested that it may be correlated with some recent change in the process of preparing the extracts for market. In any case, each lot of the product should be tested by the manufacturer, and its effect on peristalsis stated on the label of the container. It is possible that the failure in some instances clinically to obtain the supposed diuretic effect from pituitary extract may have similar explanation."

Pancoast and Hopkins² observed the effects of pituitrin under the Röntgen rays (filling the gastro-intestinal tract with contrast material in the usual manner). Eleven patients were studied in this manner. They state that while the effects were variable, there was sufficient uniformity for them to draw definite conclusions from their observations.

In the stomach, as a rule, there was a primary depressing influence upon peristalsis or motility, or both, followed by an increase in both. The same effect followed repeated doses. The pylorus was influenced very little, and, when any effect was noted, it was variable.

In the small intestine, motility was, as a rule, either not affected or slightly delayed.

In the large bowel, the drug produced little, or no, appreciable effect on motility in the patients examined.

Reflex Ileus of Renal Origin. Eisendrath, of Chicago, reports 3 typical cases of lesions of the upper urinary tract in which the symptoms of ileus overshadowed those of the underlying condition.

Eisendrath's first case was a man, aged sixty-three years, who had an enormously distended abdomen, and passage of neither feces nor flatus for over forty-eight hours. The patient stated that during recent years he had had similar attacks of colic, and with each attack symptoms of an ileus-like character had appeared. X-ray showed shadows of four small calculi in the left pelvic ureter.

The second patient was a man, aged fifty-four years. His symptoms resembled both an appendicitis and an incipient ileus. The abdominal

¹ Journal of American Medical Association, vol. lxvi, p. 733.

² New York Medical Journal, February 17, 1917, p. 289.

distention, vomiting, and inability to secure passage of feces or flatus, completely overshadowed the pain in the right iliac region. Only when red blood cells were found in the urine, was suspicion directed to the renal origin of the symptoms. An *x*-ray showed the shadow of a large calculus in the region of the left kidney (Fig. 68). The intestinal symptoms subsided after three days.

The third case was a man, aged fifty-five years, with pain in the right hypochondrium, accompanied by marked abdominal distention, vomiting, and complete obstipation. Several ileus-like attacks occurred during the three weeks before the patient's death. Whenever the ileus subsided, one could feel a mass in the right side of the abdomen. This greatly increased during the two weeks preceding his admission to the hospital. At autopsy, the kidney showed excessive hemorrhages into a hypernephroma of the right kidney. Eisendrath believes that each recurrence of bleeding and resultant sudden increase of intrarenal tension caused an attack of reflex ileus.

Eisendrath explains the reflex ileus brought to his attention by R. C. Pearce, assistant professor of physiology, University of Illinois, as follows:

Stimulation of the peripheral end of the cut splanchnic nerve brings about an inhibition of the intestinal movement and a decrease in the tone of the intestinal muscle. The ileocolic sphincter is, however, closed by such a manipulation. This is of special interest, since it shows the reciprocal action of inhibition of the movements of the intestines and the closure of the ileocolic valve. Adrenalin, which is secreted upon the stimulation of the splanchnic, acts upon the intestines in exactly the same manner as splanchnic stimulation itself.

Reflex excitation of the splanchnic may be brought about by painful stimuli in any portion of the body. Cannon has shown that severe sensory stimulation will reflectly inhibit the intestinal movements, and that this inhibition is aided by the increased secretion of adrenalin which accompanies splanchnic excitation. That the splanchnics are reflexly stimulated by nocuous stimuli is shown by the resulting vasoconstriction in the visceral vessels and the increase in the blood-pressure. A plausible explanation for the ileus described can be found in the above facts.

The receptors of the sensory nerves of the kidney, ureter, or perirenal tissues are stimulated by the passage of a stone or a hemorrhage into or around the kidney. These severe painful stimuli reach the brain through afferent nerves and reflexly stimulate the splanchnic nerves, which bring about a dilatation of the gut, a closure of the ileocolic sphincter, and an increased secretion of adrenalin, which augment the action of the sympathetics.

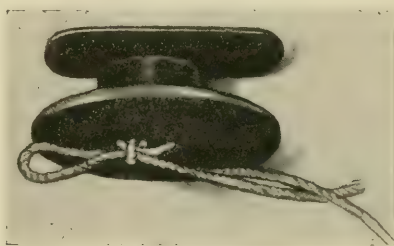
Cannon has shown that such a mechanism is brought into play in case of acute pain, emotions, fears, etc. Such relaxation of the intestines as is present in the reflex ileus described in this paper, is probably too long in duration to be wholly explained by simple inhibition, due to the mechanism of temporary stimulation of the splanchnics.

In the discussion of Eisendrath's paper, Bevan reported having seen

a number of cases of ileus in kidney colic. Some of these had been rather interesting from the stand-point of mistakes in diagnosis, in that they had been handled as cases of acute indigestion, with very marked abdominal symptoms, vomiting, and distention, which were relieved within twenty-four, thirty-six, or forty-eight hours after opening the belly.

Bevan, in speaking of Eisendrath and Pearce's explanation, pointed out that the condition is not so simply explained. If it were merely a reflex irritation, why should we not have constantly, in every case of gall-stone colic, or in every case of kidney colic, more or less evidence of this condition of paralytic ileus? Yet there are dozens of cases of renal colic without any abdominal symptoms, without any evidence whatever of paralysis.

Bevan went on to report the case of a man who died, seven or eight days after removal of a kidney stone, of a paralytic ileus in which there was an acute dilatation of the stomach without any peritonitis.



FIGS. 53 and 54.—Dowd's obturator for temporary closure of enterostomy opening.

An interesting case of *enterospasm* is reported by Aldous.¹ The patient, a woman, aged thirty-one years, was first seen with symptoms of acute intestinal obstruction. She gave a history of being struck on Christmas day, and was seen for the first time one week later. At laparotomy, three feet of collapsed ileum close to the ileocecal valve were found. The remainder of the intestine was normal. The abdomen was closed. For five days, in spite of the free administration of belladonna, there was no improvement, and because of increasing distention and persistence of symptoms, the abdomen was reopened and the collapsed ileum was found reduced to twelve inches instead of three feet as formerly. Multiple enterotomies permitted the evacuation of several pints of intestinal contents. The abdomen was closed. A free action followed a few hours later after administration of turpentine and magnesium sulphate. The patient made a rapid recovery.

¹ Lancet, August 5, 1916, p. 227.

OBTURATOR FOR TEMPORARY CLOSURE OF ENTEROSTOMY OPENING. Dowd¹ uses an inner disk, oblong in shape, which is pushed through the stoma lengthwise. It should be large enough to occlude the stoma when pulled flatly against it. The shank should fit the stoma and should be adjusted to the thickness of the abdominal wall. A knot larger than the hole in the inner disk is tied in the middle of a piece of string; the free ends are then passed through the inner disk, the shank, and the two holes in the outer disk or button (Fig. 53). With the string slackened, the inner disk is inserted through the stoma. The string is then tightened and tied firmly, thus fixing the appliance into the shape of a collar button (Fig. 54), with one flange inside the intestine and the other flange outside the skin. The intestinal leakage is thus stopped, the skin irritation disappears, and the patient's nutrition improves.

THE APPENDIX.

In speaking of the **Röntgen Diagnosis of Appendicular Lesions**, Imboden² mentions, among other things, that the Trendelenburg position affords an excellent opportunity for studying the area of the ileocecal junction and the appendix. Case, of Battle Creek, reports several instances in which left-sided appendicitis was diagnosed by means of the barium enema.

The Mythical Valve of Gerlack and the Frequency of Appendicitis in Vegetarians. Colley³ had the opportunity of making a large number of autopsies upon soldiers who had died of typhus or intermittent fever in Anatolia. As a result of his extensive anatomical studies in these autopsies, Colley states that the so-called valve of Gerlack does not exist. He also states that appendicitis occurs with as great frequency among those who live upon a largely vegetarian diet as among those who live upon a more plentiful meat diet.

Appendicitis and Pulmonary Tuberculosis. Kinghorn,⁴ of Saranac Lake, N. Y., says that appendicitis and intestinal tuberculosis are the two organic conditions of the alimentary tract, which are most frequently encountered in treating patients with pulmonary tuberculosis. Regarding operation for intestinal tuberculosis, he says that the results have not been encouraging. However, in appendicitis, the reverse is the case.

The majority of cases have the usual classical symptoms, but there are several types which do not have these and which may easily be overlooked. In the first place there is the type with symptoms of intestinal indigestion. In this connection, Kinghorn quotes the experience of Byers, who is also in touch with similar cases, and who said that he had seen relief by operation in considerable numbers of patients who had chronic symptoms of intestinal indigestion. A second type frequently seen in tuberculous patients occurred in a mild appendicitis in which the patients complained of nothing but moderately severe abdominal

¹ *Annals of Surgery*, January, 1917, pp. 98 and 99.

² *American Journal of Röntgenology*, January, 1915.

³ *Arch. f. klin. Chir.*, Band cviii, Heft 1; *Berlin. klin. Wehnschr.*, 1916, p. 1113.

⁴ *Journal of American Medical Association*, vol. lxvii, p. 1842.

cramps. It had been noted that the patients had usually taken a considerable quantity of milk. On physical examination, the physician will frequently find that such cramps are due to an appendicitis. A third masked form of appendicitis is like that described by Dieulafoy, with onset with diarrhea. Kinghorn says that we have been so accustomed to see constipation accompanying appendicitis that we may not recognize appendicitis accompanied by diarrhea.

Of 727 patients treated from October, 1905, to June, 1916, 43, or 5.9 per cent., had appendicitis, the same percentage seen in apparently healthy persons. Of these 43, 28 were operated upon, and 15 recovered without operation. Of those who underwent operation, 10 per cent. died, 2 deaths occurring on the third day and 1 on the fourth, and 1 four months after operation. The patients who died had extensive intestinal tuberculosis. In 7 of the 28 patients who were operated upon, 7, or 25 per cent., showed well-defined tuberculosis of the appendix. These 7 were among 22 who represented far-advanced phthisis, and thus the percentage of tuberculous involvement of the appendix was as high as 31 per cent. Tuberculosis of the appendix is commonly found in association with tuberculosis of the cecum. All the patients stood the operation well. In 89 per cent. there were no bad effects on either the general or the lung condition. Indeed, the operation seems to have no ill-effect whatever upon the lungs.

While Kinghorn advocates local anesthesia wherever it can be used, nevertheless, he himself employed nitrous oxide and oxygen anesthesia in the majority of cases. Chloroform was given in 3, ether was given in 3, and they experienced no ill-effects whatever. Nitrous oxide-oxygen anesthesia is the anesthetic of choice.

Kinghorn states that in acute appendicitis we should regard these cases of pulmonary tuberculosis as apparently healthy patients and that the lung condition should not be taken into consideration while making a decision regarding operation. Kinghorn considered that mortality of 10.7 per cent. in acute cases of appendicitis among the tuberculous was about the same as in healthy persons suddenly stricken with the disease.

As regards the question of operation in mild or chronic attacks, each case is a rule unto itself, but should repeated attacks endanger the health of a patient, the appendix should be removed. In one case, Kinghorn observed remarkable improvement. The patient, a feeble woman, gained 50 pounds as a result of operation and her lung condition made a corresponding improvement.

The **Liberation and Removal of the Retrocecal Appendix**, is discussed by Shaw.¹

The mobilization of the ascending or descending colon by division of the peritoneal leaf to the outer side of either of these structures, is a well-known surgical procedure. Shaw uses this in his exposure of the retrocecal appendix. After removal of the appendix, the cecum is replaced and the divided peritoneum sutured.

¹ *Annals of Surgery*, June, 1916, p. 715.

The Prevention of Fecal Fistula in Suppurative Appendicitis. Guthrie,¹ of Sayre, Pa., states that when peritonitis is present to a marked degree and the head of the cecum has become so thickened by inflammation that inversion of the stump is impossible, he resorts to the old cuff operation, turning down a fold of the thickened peritoneal coat, ligating the stump with catgut and then covering it over with the cuff tied by catgut. He believes this is a better technic than simply tying off the stump and dropping it into the abdomen. Whenever possible, this suture is reinforced by tying the cut meso-appendix over the stump, or, if not, a tip of omentum or some organized lymph from an abscess wall. For drainage tubes, he uses those of soft rubber and large caliber. These are placed as far away from the head of the cecum as possible. They are shortened early and removed as a rule by the end of the first week.

Guthrie reports fistulæ from too prolonged contact between the head of the cecum and the drainage tube. Laxatives are never given until all drains have been removed. He reports 3 fecal fistulæ in 853 drainage cases.

The reviewer believes that the simple subserous shelling out of the appendix followed by its ligation in certain difficult suppurative abscess cases is rarely followed by fecal fistula even when none of the refinements of technic mentioned by Guthrie have been employed.

The occurrence of fecal fistulæ after appendectomy in suppurative cases by avoiding pressure necrosis from drainage tubing or other drainage material, is becoming more widely adopted.

Postural Drainage in Suppurative Appendicitis. Hill² considers the prone and lateral positions afford better and more effective drainage than the Fowler position.

Among the curiosities of the past year may be cited **removal of the appendix for the cure of trifacial neuralgia** and other nerve pains about the head and face, reported by M. I. Rosenthal,³ of Forty Wayne, who reports 7 cases: "We have fixed the pathological condition in the vermiform appendix even though the physical and subjective evidence of appendicitis were so obscure as to be entirely overlooked. In all but one case there was almost symptomless chronic appendicitis of the obliterative type; the odd case was a symptomless pus case. One case was on the order of migraine, or so-called sick headache. It has not been uncommon in my experience to note the cure of migraine and so-called sick headache after removal of a diseased appendix. It was quite possible that many of these cases come under the same pathology as tic douloureux and other nerve pains about the face and head."

Sleeping on the Right Side a Cause of Appendicitis! This peculiar theory is advanced by Samberger,⁴ who conceived the idea that a large number of people who suffer from appendicitis, habitually lie on the right side during sleep, and this may have some etiological significance. He himself was in the habit of sleeping on the right side in order to avoid

¹ Annals of Surgery, April, 1916, p. 452.

² Transactions of Western Surgical Association, St. Paul, December, 1916.

³ Journal of American Medical Association, vol. lxxvii, p. 1326; Report of meeting of American Association of Obstetricians and Gynecologists at Indianapolis, September 25-27, 1916.

⁴ Zentralbl. f. Chir., 1916, p. 104.

having the light from a street lamp shine in his eyes. At this time he suffered from pain of appendicular character. As soon as he changed his residence and slept upon his left side, the pain ceased. Accordingly, he instituted an investigation among the patients with appendicitis in the *Prager Allgemeine Krankenhaus*, and found that of 53 patients who had been operated upon, 42, or 79 per cent., slept exclusively on the right side; 4 per cent. on the left and 1 per cent. on the back. Among 76 patients suffering from other diseases, only 45 per cent. slept habitually on their right side.

LARGE INTESTINE.

Intestinal Stasis.—Operations for the relief of intestinal stasis are being performed less and less frequently as time goes on and as patients with recurrences of the original constipation in aggravated form come back to the operator with their complaints. Lane's total colectomy is practically abandoned. Short-circuiting operations are no longer described in the literature. Suspension of the transverse colon is still practised in certain quarters. The most satisfactory surgical procedure for so-called intestinal stasis is the removal of the cecum and ascending colon with implantation of the ileum into the beginning of the transverse colon.

C. A. L. Reed, of Cincinnati, reports 226 operations of parietal implantation of the colon done during the past nine years. He says the object of this operation was "to restore the static colon and stomach to their normal position and keep them there indefinitely, to give freedom to the peristaltic activity and thus drain away the toxic and infectious contents of the tract!"

In the discussion, Franklin Martin stated that he had had several good results with the Coffey operation.

John G. Clark,¹ reports a series of 12 carefully studied cases of colectomy for intestinal stasis. He says that his enthusiasm has diminished rather than increased. Several of the cases did well for a time, only to develop symptoms of progressive constipation later on. At least 4 cases were just as bad as before operation and 1 died several weeks after discharge from the hospital from intestinal obstruction.

Clark reviews Lane's own experience who abandoned the side-to-side anastomosis for an end-to-side, and later on discarded this for an end-to-end union. Clark condemns total colectomy because of the removal of the great omentum and the dangers of peritoneal adhesions (which caused one death in his series and necessitated a second operation in two others). He prefers the partial colectomy (resection of terminal ileum, cecum, ascending colon) of Moynihan. (See *PROGRESSIVE MEDICINE*, June, 1915, Figs. 43 and 44, pages 138 and 139).

Clark condemns ileosigmoidostomy or any other form of anastomosis between different segments of the colon or between the cecum and sigmoid flexure. He also believes that the ileum will not vicariously take over the function of the colon in those cases where an end-to-end anastomosis between the lower large intestine and the ileum has been made, as in the Lane operation. At the present time he reports that

¹ Surgery, Gynecology and Obstetrics, May, 1916, p. 533.

in only 6 of the 12 cases operated on, could the result be considered satisfactory. In all, there was great improvement in the constipation for a time. In some of these, the x-ray showed dilatation of the ileum to almost the same size as the colon.



FIG. 55.—Removal of right colon, showing lines of section. (Mayo.)

Speaking of the INDICATIONS FOR REMOVAL OF THE RIGHT COLON C. H. Mayo¹ says: "There is just enough truth in this theory and

¹ Journal of American Medical Association, vol. lxvii, p. 779.

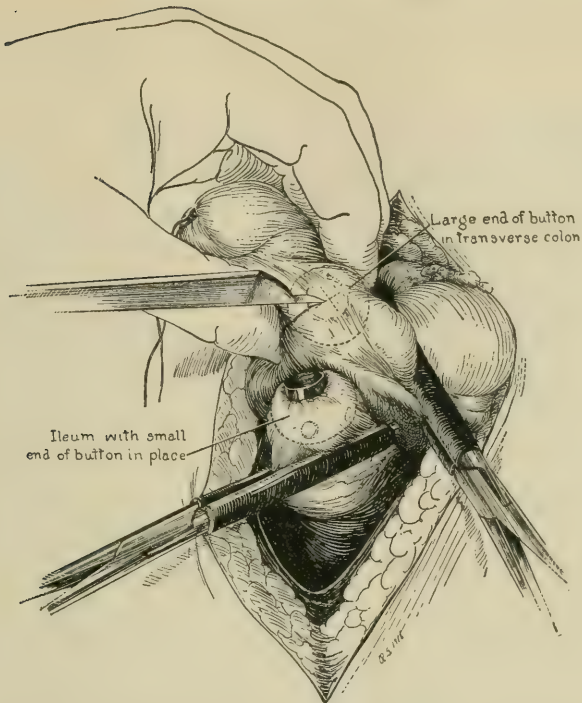


FIG. 56.—End-to-side union by Murphy button. (Mayo.)

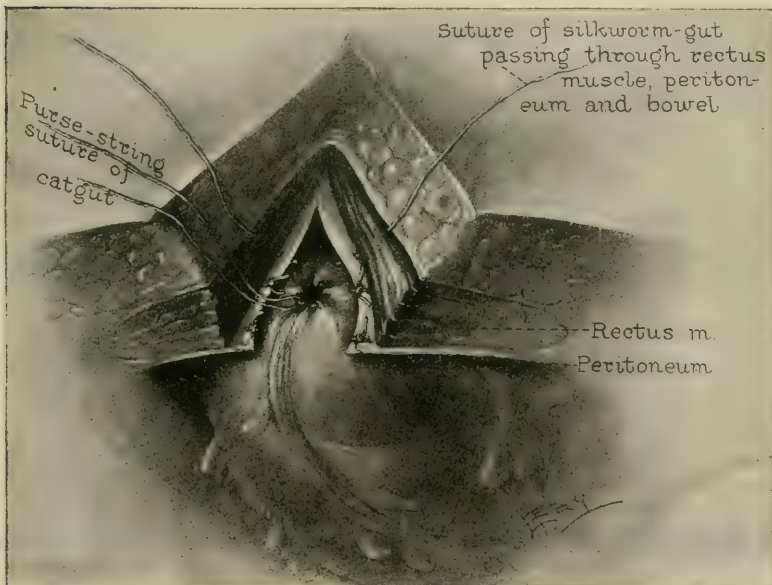


FIG. 57.—End of colon brought up to peritoneum and sutured. (Mayo.)

sufficient that is not true, to require years for standardizing the diseases and conditions between the border-lines of medicine and surgery, in which the elimination of the colon will give sufficient improvement over

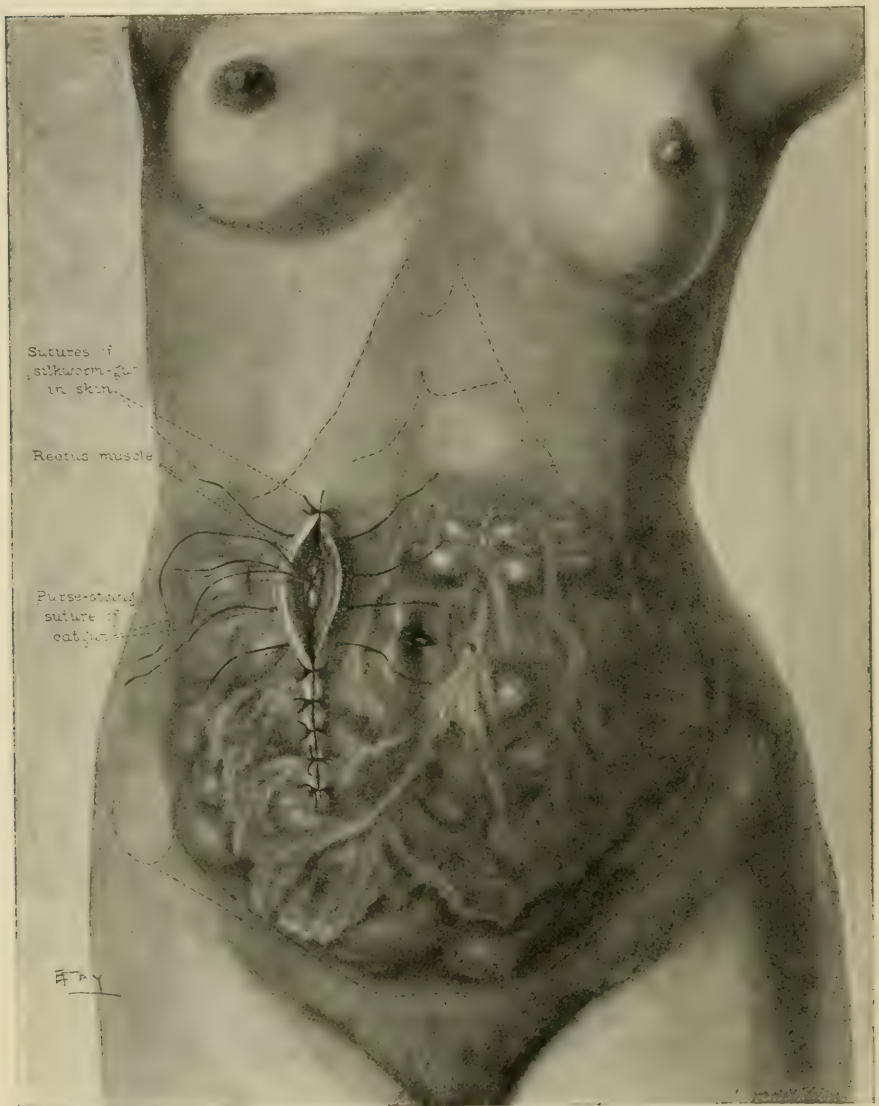


FIG. 58.—Incision, showing method of closure and end of bowel in depth of wound. (Mayo.)

the results of non-operative therapeutics to justify such surgical intervention. This period will be reached only when the collective judgment of the profession can select the proper cases. While Lane may be over-enthusiastic in his claims, he deserves credit for much of the knowledge

of the physiology and disease of the colon possessed by the medical profession today."

The patients selected by Mayo are those disabled by the condition in spite of prolonged and varied treatment, in whom the Röntgen ray showed a stasis of three or four days' duration, such as is often associated with complicated chronic infection.

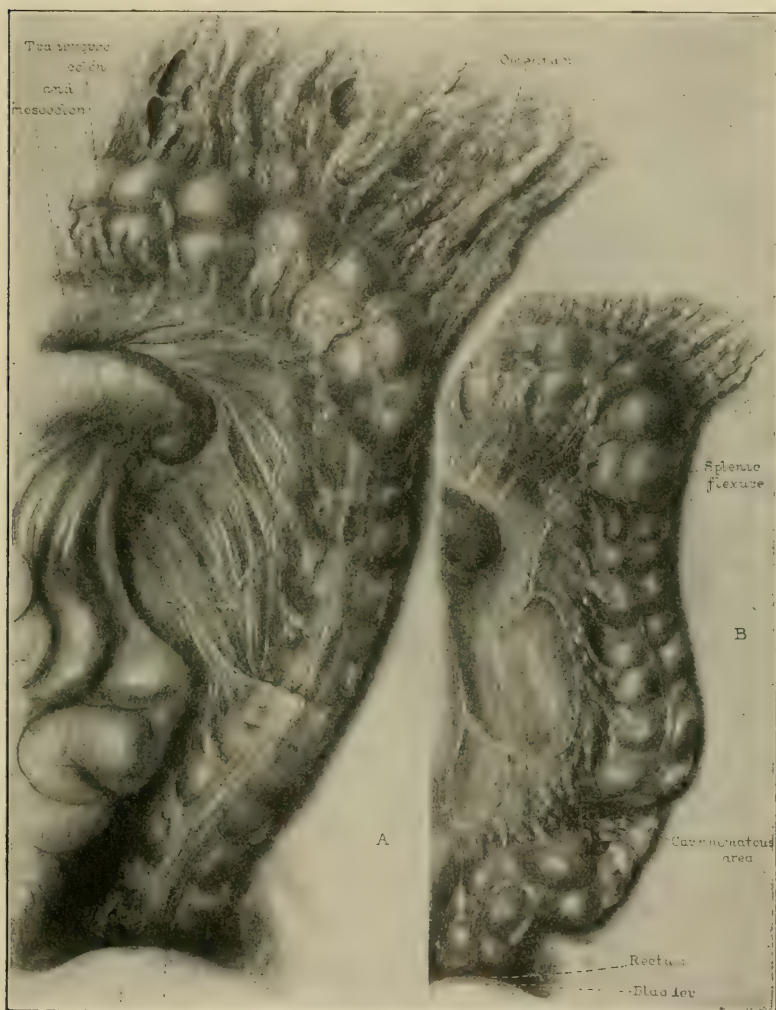


FIG. 59.—A, end-to-end tube resection completed; B, carcinoma of the pelvic sigmoid. Dotted line indicates the points of resection. (Mayo.)

Mayo advocates partial colectomy, stating that the relief from symptoms is as effective as from general colectomy. It has the advantage of preserving the omentum and thus preventing the adhesions of the anterior layers of the intestine to the abdominal wall which are so frequent after the total removal of the colon.

Mayo states that after the low ileostomy, as advocated by Brown, the lower ileum becomes dilated and takes the place of the colon. In low ileostomy, the contents of the ileum soon thicken and emptying occurs at intervals with less gas and little odor.¹

For partial colectomy, Mayo uses a very ample right rectus incision. As soon as the abdomen is opened, a general exploration is made, as is customary in all laparotomies at the Mayo Clinic. After adequate exposure and packing away of the abdominal contents to the left of the ascending colon, an incision is made along the parietal peritoneum

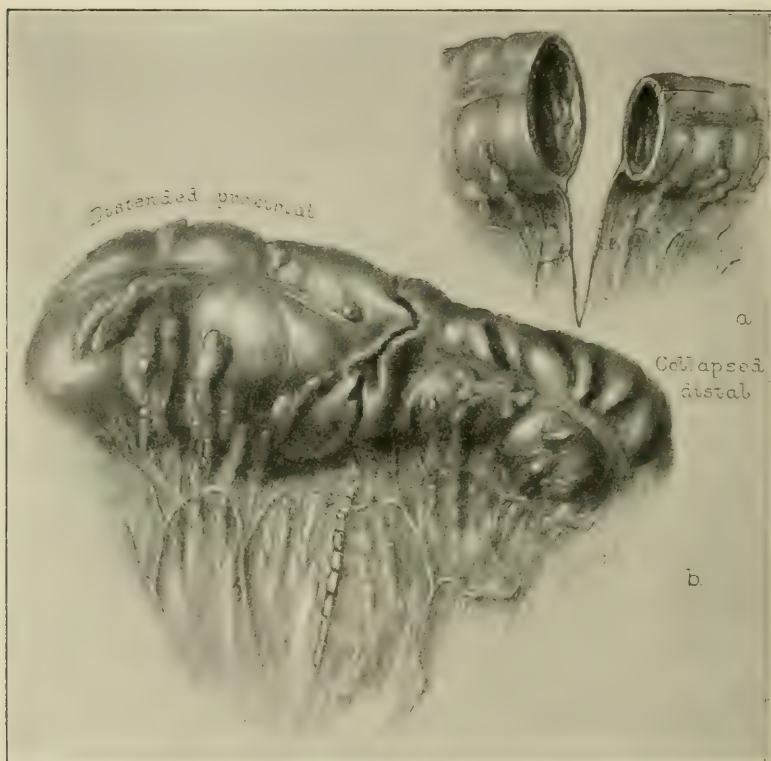


FIG. 60.—*a*, method of widening the distal collapsed bowel to meet the distended proximal bowel; *b*, operation completed. (C. H. Mayo.)

where it passes over to cover the colon on its outer side. This permits of mobilization of the colon and allows the freed bowel to be raised out of the abdomen. The space at the outer side is then filled with a protective gauze packing. The iliac mesentery is perforated and ileum divided between clamps three inches from the ileocecal valve. The cut ends are sterilized with the actual cautery. From below upward the mesentery of the cecum and ascending colon is divided between forceps up to the transverse colon and the omentum is ligated and separated

¹ See also PROGRESSIVE MEDICINE, June, 1915, Figs. 43 and 44, pp. 138 and 139.

from the right one-third of the transverse colon (Fig. 55). At this point the colon is divided between clamps and the mobilized bowel removed, the distal stump of colon being treated with the actual cautery. The vessels supplying this region are few in number and readily seen. These are ligated. In non-malignant cases, division of the mesentery is made closer to the bowel, while in the presence of tumor, the mesentery includes the lymph glands which drain the area. Care should

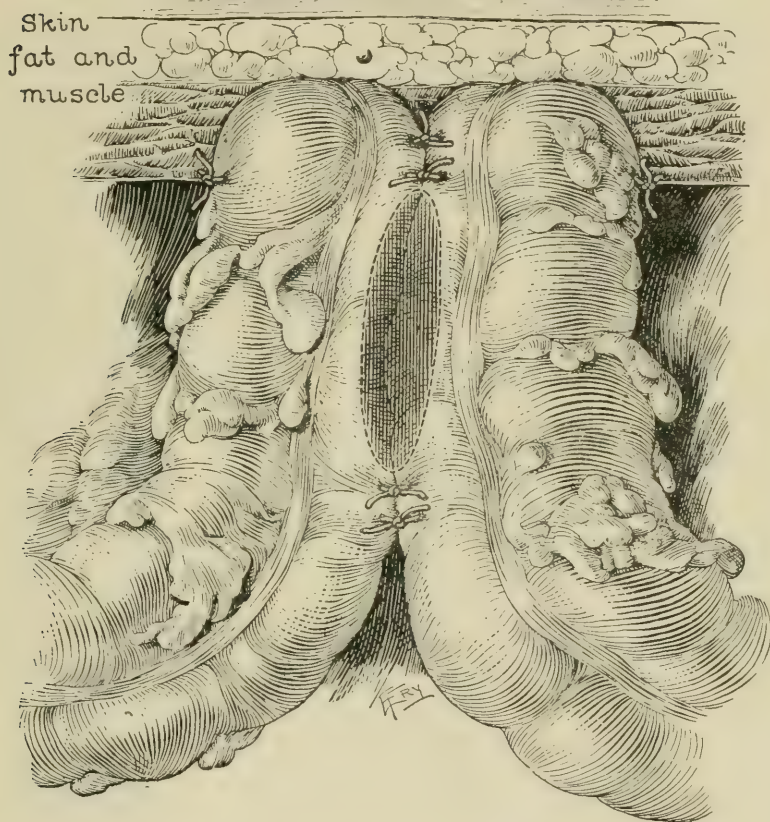


FIG. 61.—Bloodgood method of anastomosis of the large intestine. The bowel is attached to the incision in such a way that, should leakage occur, it would readily find its way to the surface. (Mayo.)

be taken in separation of the colon to avoid injury of the underlying duodenum. While the ureter can be seen on the right side, it does not come into the operative field except in the removal of lymphatic drainage in extensive carcinomatous involvements.

Using chromic catgut as a suture, the end of the colon is prepared for closing by inserting the needle and catching it into the bowel, first on one side and then on the other over the forceps, including the peritoneum and muscle, the loops crossing the forceps being left loose. The contents

of the bowel near the clamp are now milked away and a rubber-covered clamp applied for control about four inches from the end. The forceps

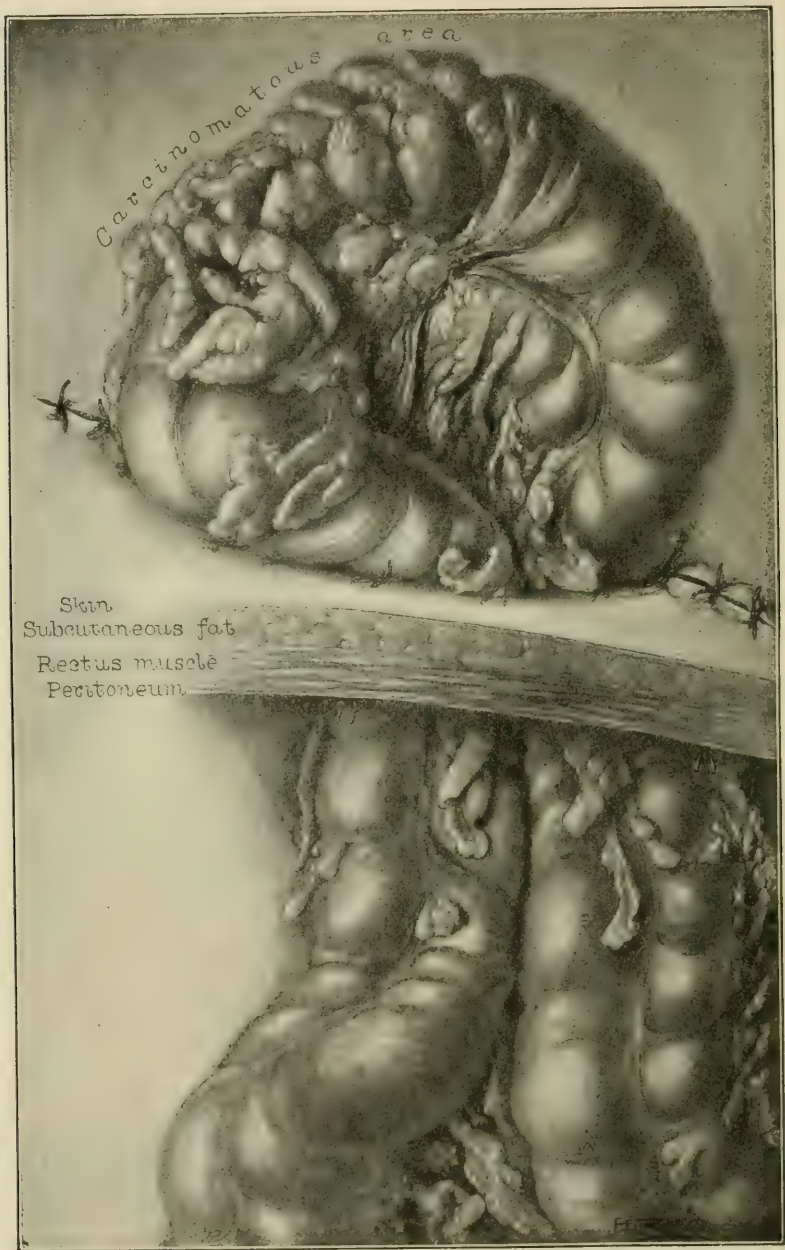


FIG. 62.—First stage of Mikulicz operation completed. The tumor, involved part of bowel, fat and mesentery being drawn outside the abdominal wall, where it will remain until it heals in. It will then be cut away, and the partition between the limbs of the bowel, as sutured together, will be cut out with forceps, restoring the lumen, and the colostomy closed. (Mayo.)

closing the end of the bowel are now removed, the end opened and the female or spring side of a proper-sized Murphy button is pushed through the loose sutures, into the opening and left loose within the colon (Fig. 56). The two ends of the thread being drawn taut, immediately invert the mucous end of the colon and approximate the peritoneal surfaces. A second row of sutures is applied to make closure more perfect, the ends of the suture being left long. (Ligation of the bowel and purse-string invagination is equally good.) The button within the bowel is so manipulated that its tube is pressed against one of the longitudinal tenia about two and a half inches from the closed end. It is incised on the tube of the button so that this can be pushed through the wall of the intestine, no suture being used. This is held until the other half of the button is adjusted into the end of the ileum by suture. The two halves are then pushed together, making an end-to-side union with the Murphy button. If necessary, a few interrupted sutures of fine catgut or silk may be used over the button, so as to adjust adjacent epiploic tags or omentum for protection or support of union. While suture may be used for this anastomosis, the Murphy button is safer, quickly adjusted and ideal for the purpose. Some operators, according to Mayo, prefer the side-to-side union in spite of a tendency to dilatation of the blind end. The triangular opening in the mesentery is sutured by catgut suture. The exposed raw bed of the colon is buried by uniting the parietal peritoneum over it. The abdominal wound is now closed, the end of the colon being drawn up into the peritoneal opening. The colon is brought into the muscle but not through it, the muscles being sutured above and below this point (Fig. 58). The long suture from the end of the bowel hangs out of the incision. A strip of gauze is inserted down to the end of the bowel to keep the muscles apart. This procedure is employed as a safety valve to relieve gas should stasis, with great distention, occur between the fourth and sixth days. Peritonitis causes most of the deaths by necrosis of union from distention. In a series of 20 cases, the Mayos have had no deaths from the use of the Murphy button and the safety-valve method. By drawing on the projecting suture and using small pointed forceps along the taut thread, the bowel is readily opened and gases permitted to escape. If not required by the sixth day, the suture is cut, the gauze removed, and the opening allowed to close. If the suture is not needed, the healing is not prolonged. If needed, closure is usually effected within a short time. This safety valve has been found of great benefit in 15 per cent. of the cases.

As to the results, Mayo says there is less postoperative improvement here than in operations of necessity for tumor or obstruction.

Ileosigmoidostomy and Similar Procedures for the Treatment of Chronic, Multiple, Non-tuberculous Arthritis. Ten cases are reported by Bottomley,¹ in 8 of which ileosigmoidostomy was performed. There was no mortality. The immediate effect was always beneficial, and the amelioration continued sometimes for weeks or months. Bottomley himself says: "I must admit that my mind is not entirely clear either as to why

¹ Journal of American Medical Association, vol. lxvii, p. 783.

operation benefits some cases and does not influence others, or as to just what it is that operation does in some cases and fails to do in others with, or without, relief to the patient."

Bottomley acknowledges that doing away with the so-called ileac stasis is not the curative factor, for in the only case, that of a young man cured three years after operation, the x-ray showed a markedly dilated ileum and all the röntgenographic signs of ileac stasis.

Rea Smith, of Los Angeles, in the discussion, conceded that he was not as enthusiastic now as formerly. He reports 12 patients living, 3 perfectly well at twenty-eight, twenty-six, and eighteen months after operation. One case had to be reoperated upon two months later for acute obstruction in the ileum, due to postoperative adhesions.

Experimental Colonic Stasis. Frazier and Peet¹ reversed sections of the colon above the sigmoid, varying in length from four to six inches, and reuniting them to the gut with end-to-end anastomosis. In a few dogs, dilatation of the reversed colon was found at autopsy. This was invariably due to partial obstruction from stenosis at the lower anastomosis. In no case did this added stasis make an appreciable difference in the result.

The possible action of the liver in removing, before they could be excreted by the kidney, appreciable quantities of the absorbed products of intestinal putrefaction, was determined by the production of an Eck fistula with ligation of the portal vein above the venous anastomosis. The dogs with Eck fistula differed in no way from those with simple reversal of the colon. The chemical analysis of the urine was the same as before; the stools were well-formed and the animals ate well. In short, Frazier and Peet consider that mere stagnation of feces in the colon of the dog, when on a normal mixed diet, does not lead to the formation of toxic substances of note and that simple colonic stasis in the dog is harmless. They therefore consider that the symptoms attributed to colonic stasis in man are due to some other cause than the absorption of products due to simple fecal stagnation.

Vaccine Treatment in So-called Chronic Intestinal Toxemia. Considering the uncertain footing on which the theory of chronic intestinal toxemia is based at the present time, one should necessarily be cautious in accepting any theories regarding vaccine treatment for this syndrome of nebulous origin. It has not been proved that the colon bacillus is the specific organism in this condition, and consequently the vaccine made from such an organism need not necessarily be indicated.

► **Intestinal Stasis and the Bacillus Epilepticus as a Cause of Epilepsy.** During the past year, C. A. L. Reed, of Cincinnati, who is an enthusiast on the subject of intestinal stasis has again strenuously advocated his theory that a bacillus which he has been able to isolate from the intestinal canals of epileptics (which he has named the *B. epilepticus*) is the cause of epilepsy.

According to Terhune,² the bacillus was isolated from 75 per cent. of epileptics examined; was present during and following a seizure, but

¹ Annals of Surgery, June, 1916, p. 729.

² Journal of American Medical Association, vol. lxxvii, p. 1155.

not present in the intervals. It was not found in non-epileptics. Upon injection into cats, it caused typical epileptiform convulsions.

Powers and Lahey,¹ of Boston, report a case which they consider epilepsy caused by intestinal stasis. In a case of epilepsy of eight years' standing, which had resisted treatment by bromides and various dietetic measures, a colectomy was performed (in September, 1914), after which there was freedom from attacks for five months "in spite of neglecting his diet." In March, 1915, there was another attack; after this he submitted to dietary regulation and has enjoyed freedom from attacks. The patient had two unformed movements daily.

Wherry and Oliver,² of Cincinnati, considered that one of the cultures from Reed's series of cases was an organism which belonged to the *B. subtilis* group. In the 5 cases of Reed's own series studied by them, they could not isolate any such organism, and also failed to find any bacteria in smears stained by the Giemsa stain and by Abbott's spore stain and other methods.

In 160 blood cultures made by Caro and Thom³ upon epileptics in Massachusetts, there were 156 sterile cultures. The remaining 4 showed contaminations. In a series of 17 autopsies on epileptics, Canavan, in a bacteriological study, was unable to find any organism resembling *Bacillus epilepticus*. In the 70 epileptic patients studied, Caro and Thom believed that the epileptic syndrome was not due to the *Bacillus epilepticus* of Reed.

Reed's⁴ reply shows that the matter is still undecided.

Exclusion of the Intestine. Finsterer,⁵ an assistant in Hochenegg's Clinic, advocates the method employed by his chief for exclusion of the intestine since 1891, namely, the sewing of both proximal and distal ends of the excluded gut into the abdominal wall. Finsterer was able to collect 100 cases from the literature and adds 12 operated upon in the last ten years at the clinic of Hochenegg. In 41 cases the method of Hochenegg was employed of sewing both ends of the gut into the abdominal wound. In 18 cases the method of Salzer—closure of the proximal and establishment of a fistula at the distal end—was employed. The disadvantage of this latter method is, that it requires more time, and that a local peritonitis may originate from the buried, blind end of the gut, especially if there is a stenosis between the buried, blind end and the proximal end. Closure and burial of the distal end, with suture of the proximal end into the abdominal wall, is to be condemned, because of the constant tendency for peristaltic movements to carry the contents (detritus and mucus) toward the blind, distal end which puts an undue strain upon the suture line and readily leads to a leakage and peritonitis. In 38 cases, both proximal and distal ends were closed and the excluded gut replaced in the abdominal cavity, a communication between the isolated duct being established by means of a fistula. In 14 of these 38 cases, the fistula closed or was closed at

¹ Boston Medical and Surgical Journal, July 27, 1916.

² Journal of American Medical Association, vol. lxvii, p. 1087.

³ Ibid., p. 1088.

⁵ Brun's Beiträge f. klin. Chir., 1916, xcix, Heft 1, p. 1.

⁴ Ibid., p. 1157.

subsequent operation. This procedure led to the gravest complications; in several instances, however, these came on only after many years of total exclusion. In 6 other cases the total closure and isolation of the excluded gut was performed according to the method of Baracz and Obalinski. An especially noteworthy case was one in which Hochenegg performed total exclusion of the ileocecal region for tuberculosis, and removed the excluded section of gut nine months later. Microscopic examinations showed that the local tuberculosis had completely healed. To recapitulate: the total exclusion according to Hochenegg with suture of both ends of the gut into the abdominal wall is the safest and shortest method. A blind closure of both ends and establishment of a fistula, as well as the simple blind closure and burial of the isolated segment of gut, are to be condemned.

Ochsner¹ considers that *obstruction to the passage of gas is one of the greatest dangers following operations upon the colon*. To avoid this, a number of methods have been devised. According to the one by Reder,² after the cecum has been extirpated and the ileum anastomosed side-to-side with the transverse colon, the end of the ileum is passed out through a buttonhole in the abdominal wall about 10 cm. beyond the point at which the anastomosis between the closed end of the transverse colon and the end of the ileum is made. A tube is inserted into the free end of the ileum to permit escape of gas until perfect healing has taken place between ileum and transverse colon. When the drainage tube is removed, the wound is supposed to close spontaneously.

C. H. Mayo (see above) uses the end of the transverse colon for the same purpose, anchoring it into one angle of the abdominal wound, but does not open it unless occasion demands. If mechanical considerations prevent the anastomosis of ileum to transverse colon, Ochsner suggests the performance of an ileosigmoidostomy as indicated, carrying a rubber drainage tube, 1.5 cms. in diameter, up through the rectum, past the enterostomy opening into the ileum, and fastening it in position by means of a few fine silk sutures at the point of anastomosis, a method introduced by Arbuthnot Lane in his short-circuiting operation. Ochsner also suggests leaving the distal end of the ileum, which is attached to the cecum, open and passing it through a buttonhole in the abdominal wall opposite McBurney's point so that a fistula is established through which the cecum can be irrigated.

While both these procedures will do as temporary makeshifts, it may be pointed out that ileosigmoidostomy frequently leads to accumulation of impacted material in the proximal blind end of the large gut (see Finsterer above, also previous numbers of this review in recent years); further, unless a drainage tube is passed down it into the cecum, the simple establishment of a fistula by implantation of the distal ileum into the abdominal wall will not of itself act as a vent for gases, provided the ileocecal valve is competent.

W. J. Gillette, of Toledo, has added still another modification, exclusion of the entire colon with end-to-end implantation of the ileum to the

¹ Journal of American Medical Association, vol. lxxvii, p. 483.

² See PROGRESSIVE MEDICINE, June, 1915, p. 157.

upper end of the rectum. The advantage claimed for this is that it reduces the danger of exclusion of the colon by preservation of the great omentum; it is supposed to be useful in stubborn cases of intestinal stasis, with openings at both ends, so that irrigation can be made. (See Finsterer, above.)

Ochsner points out that after resection of the colon for tumor, the upper segment of the colon is usually of much greater diameter than the lower end, having been overdistended because of the obstruction. Because of this, it is sometimes difficult to invaginate the upper into the lower segment unless the drainage tube which has been chosen is sufficiently small to prevent overfilling the lumen of the lower segment. Ochsner also suggests cecostomy or colostomy of the ascending colon in very old patients when their condition precludes the demonstration of the location of obstruction.¹

In the discussion which followed, Haggard, of Nashville, reported success from utilization of the stomach-tube passed up through the rectum, past the opening of the small intestine, also from appendicostomy, to permit the escape of gas.

Reed, of Cincinnati, condemned the use of the ileosigmoidostomy as indicated by Ochsner. Reed found that the introduction of the tube into the small intestine sometimes caused strangulation and instead of a stiff tube like a stomach-tube, prefers a soft-rubber tube.

The Radical Extirpation of Cancer of the Second Half of the Large Intestine, Exclusive of the Rectum. W. J. Mayo,² states: "It is our earnest purpose to increase the operability, (1) by endeavoring to secure the cases at an earlier date, and (2) by extending the limit of operability. Increasing experience shows that some of the cases which at the time of examination had been considered inoperable may be resected by modern methods, with a prospect of permanent cure. In spite of the fact that this extension will add many advanced cases to the list, we would be able notably to reduce the death-rate in the whole number by improvement in technic and at the same time make the operation more radical."

As will be seen below, fixation *per se* does not mean inoperability, as was formerly held; as long as there are no metastases, and the structures to which the tumor is adherent were removable, they operate. In certain cases coming to the Mayo Clinic,³ the patients had been explored elsewhere and had been declared inoperable from one to several months previously. In this type of case the tumors are usually adherent to the incision in the abdominal wall, and it is necessary to make a block removal of the entire area over the growth. Here there is greater danger from recurrence in the abdominal muscles than from recurrence within the abdomen.

Mayo makes an ample working incision through the middle of the left rectus muscle, ligating the deep epigastric vessels above and below. After making sure that no extensive metastatic deposits are present in the liver and elsewhere, the outer and posterior attachments of the colon are divided so as to mobilize it. The splenic flexure is retained in

¹ Rutherford and Morrison: PROGRESSIVE MEDICINE, June, 1916, p. 155.

² Journal of American Medical Association, vol. lxvii, p. 1279.

³ Ibid., p. 779.

position by the splenocolic ligament, which is derived from the omentum and contains a bloodvessel which must be tied. The outer leaf of the mesentery in the pelvic colon, in the female, is closely associated with the left broad ligament, and here again are vessels that must be ligated. Posteriorly, the left ureter must always be identified and separated. As a rule, in the operable cases, it is possible to dissect the ureter safely from the growth; but in several instances the Mayos have found it necessary to resect a portion of it, tying the ends with catgut when it was involved in a situation in which it was impossible to reimplant the ureter into the bladder or suture the cut ends together. This permanent ureteral obstruction has not been followed by any unfavorable results, and in no case has it been necessary to remove the kidney at a later date. On one occasion, close attachment to the left kidney in an otherwise operable case made it necessary to remove the kidney with the growth. The patient has now remained well more than three years. The right ureter should be identified, but will seldom be found involved. As said above, attachments to the abdominal wall from the direct extension of the growth are not infrequent, and the Mayos have not hesitated to remove large sections of the involved tissues when necessary. These extensive dissections did not add to the mortality, and some of the cases, in which the growth was so fixed as to be apparently inoperable, have been cured. It has been found, therefore, wise to loosen the colon from its outer attachments and remove all the involved tissues with it in a single piece. Among the most difficult dissections of this kind are those in which a previous exploration has been made followed by a fecal fistula, or in which a colostomy has been performed for the relief of obstruction. Even in these complicated cases, all the structures of the abdominal wall on the other side can be freely dissected if necessary, turning the colon and involved tissues toward the midline. The bleeding vessels are caught and tied and large gauze packs placed in the raw cavity, which is left undisturbed until the operation is completed. The mobilized colon can now be held up so that, by transillumination, the bloodvessels can readily be identified. It is seen that the lymphatic supply of this part of the intestine is scanty, and herein lies the success of these operations, according to Mayo. He quotes the statement of Butlin that in 60 per cent. of the fatal cases the patients die from obstruction, local infection, etc., before the glands are involved with cancer, *i. e.*, they died from intercurrent affections while the malignant growth was still localized. Moreover, enlarged glands examined microscopically have often shown only inflammatory changes but no carcinoma. In a number of instances Mayo has resected the colon of patients who had been previously explored and who had been refused a radical operation on account of glandular involvement supposed to be carcinomatous, and, on removal, no carcinomatous tissue was found in the lymph nodes.

RESECTION OF INVOLVED ADJACENT ORGANS. The *small intestine* has been frequently found adherent to the carcinomatous mass. The Mayos have not hesitated to resect one to three separate loops of small intestine, making end-to-end unions and removing the diseased colon with the attached loops of small intestine. Experience has shown that

any reasonable method of anastomosis will be effective, lateral or end-to-end. The general tendency is to take up too much time with these resections in suture, more than is necessary or desirable. Of late, the Mayos have been more inclined to the end-to-end union with a continuous through-and-through chromic catgut suture protected by a few interrupted silk sutures in the musculo-peritoneal coat.

The ends of the small intestine which are left attached to the colonic tumor are crushed, ligated, and thoroughly sterilized with the cautery to prevent soiling.

If in low sigmoid tumors the *bladder* is involved, considerable portions of its posterior wall have been removed. As a rule, only the peritoneal and muscular walls of the bladder were found involved and the mucous membrane was left intact. By the use of chromic catgut sutures protected by a few interrupted sutures of the same character, union seemed to have been very certain. Mayo states that he has never known a bladder to leak following such an operation.

Involvement of the *uterus* and *adnexa* is of small consequence. Usually, an incision is made through the peritoneum in front of the cervix and the cervix is then divided directly across, grasping the uterine vessels and dissecting the broad ligament from below upward on each side. Thus, the uterus, with the ovaries and tubes, have been removed *en masse* attached to the sigmoid tumor. Mayo states this to be a safe procedure, as it leaves the adherent uterus to block the point at which the bowel has been weakened by penetration of the tumor, and thus prevents flooding of the wound with septic material. He states that the ovaries should be always removed if any involvement is suspected, as they are the most frequent seat of seat of secondary deposit from any involved organ in the abdominal cavity. Removal of the *appendix*, should it be adherent, calls for no special mention.

According to the treatment just outlined, the colon and all involved adherent tissue can be delivered outside of the abdominal cavity. The further steps will depend upon whether it has been possible to thoroughly prepare the patient and whether or not obstruction is present. Because of the greater infectivity of liquid stool, it has been found undesirable to evacuate the bowels by means of cathartics within twenty-four hours before operation. Any catharsis should be made at least forty-eight hours before, to prevent the presence of a liquid stool within the bowel at the time of operation. Mayo states that the primary resection in the presence of even moderate obstruction is seldom permissible. The soggy intestine proximal to the obstruction is edematous and septic, and is extremely liable to suture-perforation. Mayo advises a cecostomy under local anesthesia if the obstruction is urgent, or a colostomy made as close as possible to the growth, so that it can be excised when the resection is performed later, or, still better, in the majority of cases, he performs the two-stage operation of Mikulicz and Bruns (Fig. 62).

PREPARATION OF PATIENTS. Many patients come to the operator in extremely poor condition with obstruction. Lavage of the stomach, maintenance of body fluid by subcutaneous saline and proper attention

to the obstruction may relieve it, and operation may be deferred until after passage of flatus and bowel contents have been obtained. Primary resection, if the conditions are favorable, with an end-to-end anastomosis, is well done by the Balfour tube method. A rubber tube of considerable caliber (a sigmoid tube) is passed from the anus to some inches above the anastomosed area. These tubes are frequently passed well up into the splenic flexure. A large sized, rather firm stomach-tube with a few lateral eyes near the tip answers the purpose (Fig. 59). The sutured area should be attached to the peritoneum if there is any doubt whatever as to the safety of the anastomosis, or it may be brought completely through the peritoneum, the latter being attached behind it so that it lies within full view, and any leakage will be on the surface. If the colon is too short for this maneuver, the sutured area may be suspended on a roll of rubber tissue so that it will develop adhesions and the suture line will become extraperitonealized.

In applying the end-to-end suture, there is an unconscious tendency to draw the sutures tight and thus to narrow the lumen. C. H. Mayo has devised a means of overcoming this, by making an incision along the free surface of the colon opposite the mesenteric attachment three-quarters of an inch on each side and trimming off the corners. When the suture is complete, the lumen is widened to that extent at the point of anastomosis (Fig. 60).

The Bloodgood method of colonic anastomosis also serves an excellent purpose (Fig. 61). Regarding the Mikulicz-Brunis Vorlagerung (Fig. 62), introduced at the Mayo Clinic by C. H. Mayo, about twelve years ago, W. J. Mayo states that this has probably done more to extend operability and reduce mortality than any other measure. After liberation of the growth and its delivery, the sound colon for several inches above and below is well cleared and the afferent and efferent arms are sutured, the tumor and sufficient quantity of intestine being left outside the abdominal cavity. The peritoneum is sutured around the base of the extruded mass so that it becomes entirely extraperitonealized and it is allowed to heal into the incision. In three to seven days later the mass is cut off, the two ends of the intestine being left like a double-barrelled shotgun. Should there be obstruction at the time of the first operation, the method of Paul is advisable—that is, after the sigmoid is fixed firmly in the wound to prevent retraction within the abdomen during sudden strain the tumor mass is cut away, leaving the ends of the sigmoid projecting one inch or more. A rubber tube one inch in diameter is fastened into the proximal bowel to carry the obstructed contents into a container. In many cases in which the circulation in the extruded loop is cut off, it is a good practice to cut the tumor away at once after tying and sterilizing the ends of the bowel, as advised by Peck. This prevents soiling for from twenty-four to forty-eight hours or until the wound is protected, and, if the patient has been well prepared, the temporary obstruction is borne without difficulty.¹

¹ At times, C. H. Mayo (Journal of American Medical Association, vol. lxvii, p. 783) has found appendicostomy of value for permitting escape of gases in cases where he was lead to operate for obstruction of the left colon (by resection or vorlagerung).

At a second stage, ten or twelve days after the primary operation, during which time the bowels have been thoroughly evacuated, one blade of a four-inch clamp is placed in each opening of the colon and the clamp closed to the first notch. Each day it is tightened until, at the end of about six days, it has cut its way through, converting the outer ends of the double lumen of the intestine into a single cavity. A few days later the resulting colostomy can be closed by a simple extraperitoneal operation. Mayo states that if leakage occurs, it is usually in the second week, owing to the perforations at the suture line after the sutures have fulfilled their purpose. "We have found chromic catgut for gastrointestinal suture less liable to this complication than silk or linen."

The Mikulicz-Bruns Vorlagerung can be applied to very low growths. According to Mayo, it is astonishing to what extent even the upper part of the rectum can be brought into the abdominal wound. On many occasions they have been able to remove the rectosigmoid growth in this way, separating the rectum within an inch of the anus, and, by loosening and depressing the parietal peritoneum, have succeeded in maintaining the growth exterior to the abdominal cavity. Often it is necessary to pack gauze around the protruding mass to support it in the wound beyond the peritoneum. The gauze support should be left from ten to sixteen days. In very fleshy patients, nevertheless, they have been able to bring the involved bowel just outside the peritoneal cavity and have left it surrounded by iodoform gauze for as long as eighteen days. When the tumor is finally cut away, the anastomosis will often complete itself without any secondary operation.

In the presence of abscess cavities of considerable size in the pelvis, the growth need not be considered inoperable. However, here it is necessary to completely close the pelvis, following the operation, by loosening up and attaching the peritoneum so as to protect the abdominal cavity, and, in the female, to drain through the vagina. In the male, the entire small pelvis must be packed with iodoform gauze. Such pelvis abscesses are more frequently encountered in the female than in the male. At times it may be simpler to terminate such operations by a permanent Mixter colostomy, in which the proximal end of the large intestine, after removal of the diseased portion, is brought out through a median incision just below the umbilicus. The rectum below is cut across just above a right-angle clamp, the stump being sterilized with the cautery and the clamps left in place surrounded by iodoform gauze. The clamps are removed at the end of a week, and the gauze in the latter part of the second week. As a rule, it is best to fasten the peritoneum at the brim of the pelvis to the sigmoid.

Mayo states that despite the formidability of these operations, they have had a considerable percentage of permanent cures, and in the cases in which the disease returned, the patient had been given a long respite of comfortable existence which could not have been obtained by a palliative colostomy. There were 262 operations, of which 54 per cent. were alive and well more than five years after; 67 per cent. are alive more than three years after.

Sigmoidovesical Fistula. R. C. Bryan,¹ of Richmond, Virginia, was able to collect 40 cases from the literature, to which he adds one of his own. The appended etiological table is of interest.

Sigmoid diverticulitis	15 cases
Probable sigmoid diverticulitis	6 "
Inflammation (?)	4 "
Surgical traumatism	3 "
Carcinoma of sigmoid	3 "
Carcinoma of bladder	2 "
Carcinoma not specified	2 "
Ovarian abscess	2 "
Amebic sigmoiditis	1 case
Carcinoma or gumma of sigmoid	1 "
Tuberculosis	1 "
Stricture	1 "
Ulceration	1 "

Bryan's own case was in a syphilitic individual with a stricture of the sigmoid. There was great dilatation of the gut proximal to the stricture. This had ulcerated through, and the ulceration had established a communication between the sigmoid and the bladder. Bryan's article comprises an excellent summary of our present knowledge regarding this subject.

The Treatment of Fecal Fistulæ by Bismuth Paste. Beck,² reports success in 65 per cent. of his cases of all kinds. He lays stress on certain details of technic, namely, that when the sinuses are very long and tortuous the paste should be injected in a liquid state (previously warmed), so that it will flow readily into every part of the tract.

In fecal fistulæ he advises a thicker paste, so it will not run into the bowel but will fill out the usually wide channel and so prevent escape of fecal material. The consistency of the paste is regulated by heating the mixture. If the mucous membrane of the bowel protrudes above the skin, the bismuth paste method is not applicable. However, a fecal fistula which is deep, and communicates with the exterior through a long channel, is a suitable type for trying the bismuth paste. Beck says it is a fortunate circumstance that precisely in those cases in which operations are very difficult or impossible, the paste is of excellent service, while in those cases favorable for operation the paste is of comparatively little value.

If a fecal fistula has developed, he advises waiting at least two weeks for spontaneous closure before trying the paste. If, by this time, the fistula has not entirely closed, it is usually narrowed to a small caliber and the injections are instituted at intervals of one or two days with just enough paste to fill the sinus without an excess into the bowel. No attempt is made to pack the sinus with gauze, but an external dressing is merely placed over the wound. No irrigation is needed before the injection.

Among other cases reported by Beck was one of a woman with fecal fistula of five months' standing. The sinus had narrowed to a pin-head after three weeks of bismuth treatment. She has been well for five years.

¹ Annals of Surgery, March, 1916, p. 353.

² Surgery, Gynecology and Obstetrics, May, 1916, p. 507.

In a second case a branched fecal fistula of five months' standing was closed after a course of bismuth paste treatment extending over five weeks. In still another case with a history of six months' discharge of feces, a single injection resulted in complete and permanent closure.

Beck speaks of *bismuth poisoning* and says one should not allow large quantities of the paste to remain within the body for a long period of time. Should symptoms of poisoning appear, the paste must be removed by washing out the cavity with warm olive oil. The sterile oil should be injected and retained from twelve to twenty-four hours in order to produce an emulsion with the bismuth mixture. This emulsion is then withdrawn by means of a catheter or suction syringe. Scraping out of the paste with a scoop is a dangerous procedure, because it opens new channels for absorption.

Megacolon. J. C. Hubbard¹ reports the case of a woman, aged twenty-four years, in whom he divided the ileum just above the ileocecal valve, closing both ends. The upper end was then implanted into the upper rectum (lower sigmoid) by a lateral anastomosis. The sigmoid was divided just above this and the lower end closed, while the upper end was brought up into the abdominal incision. At operation, about six months later, the excluded intestine, namely, the sigmoid and colon, including the cecum and lower ileum, was removed. The upper end still contained putty-like masses of material. A loop of the intestine was found adherent to the abdominal wall under the fecal fistula. This was dissected free and the opening in it sutured.

RECTUM.

Carcinoma of the Rectum and Rectosigmoid. Here too operability has been greatly extended. W. J. Mayo² states that at the Mayo Clinic during the years 1913-14-15, 277 patients, with carcinoma of the rectum and rectosigmoid, were examined and 199 of these were subjected to radical operation, an operability of 71 per cent. This increase was due to the fact that the Mayos did not refuse the radical operation because of the local extent of the disease unless it involved structures which made eradication impossible.

In some cases a total hysterectomy was performed coincidentally because of extension of the disease to the uterus. In other instances (12) the posterior wall of the vagina was removed. In still others, a part of the posterior wall of the bladder was resected. The whole or part of the prostate or one or both seminal vesicles were also removed. In two instances the pelvic portion of one ureter was resected, the ends of the ureter being tied with catgut without causing marked symptoms from obstruction of the ureter. In another, the greater part of the membranous urethra, the prostate, both seminal vesicles, and the posterior half of the neck of the bladder were involved and removed. This patient lived nearly three years in good health before dying of metastasis. In 5 cases, one or more loops of the small intestine were resected because of direct extension of rectosigmoid cancer.

¹ Annals of Surgery, March, 1916, p. 349.

² Ibid., September, 1916, p. 304.

As to glandular involvement, some patients in whom the rectal glands were involved recovered and remained well, but none of those in whom the inguinal glands were involved made a permanent recovery even after the most extensive glandular excision.

The most frequent causes of inoperability were, in order of their frequency: (1) local extension of the disease to neighboring organs; (2) metastases in the liver; and (3) peritoneal and retroperitoneal metastases.

Theoretically, at least, the abdominal cavity should be explored in every case of carcinoma of the rectum before a radical operation is undertaken. If this is done, a number of patients will not be subjected to serious and mutilating operations in whom the possibility of cure is hopeless from the beginning.

In the group of cancers which occupy the region of rectosigmoid junction, the question of operability is most difficult to decide. Increased radicality of operation is shown by the change in statistics, and, at the same time, the mortality dropped. During the years 1913-14-15, the operative mortality averaged 12.5 per cent., and the operability 71.8 per cent. Increased experience has now brought the mortality down to about 10 per cent., and Mayo believes a wiser selection of cases for operation will still further reduce the death-rate. The increasing limits of operability have raised the operative mortality to a certain extent.

In discussing the *mortality*, obese male patients gave an almost prohibitive mortality from the one-stage combined abdominoperineal operation. However, these cases withstood the two-stage operation well, and also operation from behind, as the perineal or Kraske. In such fat patients in whom the colostomy itself was made with difficulty and attended by a very considerable risk, the Mayos frequently made the posterior radical operation in a single stage without exploration or colostomy, completing the operation with a posterior anus at, or near, the normal situation.

The causes of operative death have been classified as follows:

1. Sepsis, 39.8 per cent., due usually to soiling of the wound or peritoneal cavity during the operation—usually in cases in which the growth had caused obstruction—consequently radical operations are seldom permissible until the obstruction has been relieved. Few of the patients in whom the growth was movable died from sepsis following operation, but in those cases where the growth was fixed, especially if the growth was near the peritoneal cavity, the mortality was high. This was particularly true of rectosigmoid cases often complicated with abscess of the pelvis and adhesions to the small intestine. In this group the mortality was more than 30 per cent.

In reply to the question whether a radical operation under these circumstances is justifiable, the answer is given by this point of view: Colostomy in such cases is a most meagre palliative measure, and radical operation in nearly 20 per cent. of such extremely advanced cases, has given a five-year cure.

2. Nephritis, 13 per cent. Postoperative administration of subcutaneous infusion has been a useful factor in preventing failure of kidney function,

3. Undiscovered metastatic tumors, 10.5 per cent. Some of these were buried in the substance of the liver. Patients with metastatic cancer have little vitality and often die from exhaustion following an operation which would not have been performed had the true condition been known.

4. Hemorrhage, 6.5 per cent. While no patients died directly from hemorrhage, 2 died from so-called secondary shock. Mayo says: "Unless there has been hemorrhage, I have not seen shock." He goes on to state that prolonged operations with great traumatism may cause shock without actual loss of blood, for the condition is the same, the blood being withdrawn from the general circulation and lies in the suddenly dilated venous trunks of the abdomen.

5. Obstruction of the bowel following operation. Great care must be taken in closing the gap in the pelvic peritoneum so that the small intestines will not prolapse through. For this reason a continuous chromic catgut suture should be used for closing the wound. Two patients were lost some time after operation from chronic obstruction of the bowels where interrupted chromic catgut sutures had been used and it was found that part of the lateral wall of the small intestine had been pushed through a small crevice in the suture line. In 1 case, inclusion of both ureters was accidentally made in suturing the peritoneum to close the pelvic cavity. The ureters had been in full view but too much of the peritoneum and lateral structures of the pelvis were taken up in the sutures in attempt to secure a firm closure.

FUNCTION AFTER OPERATION. The best function has been obtained by the tube method described by Balfour and C. H. Mayo,¹ of end-to-end union between the sigmoid and anal canal. Mayo believes that the Weir method of invaginating the growth through the anus, amputation, and direct through-and-through suture from the mucous surface has given excellent results in the limited number of cases in which this invagination was feasible. Attempts to save function, however, have often resulted in an incomplete eradication of the disease.

As to *colostomy*: Mayo advocates the Littlewood method, which places the colostomy in the waist line above the left anterosuperior spine of the ileum. This obliterates the peritoneal space to the left of the colostomy and prevents the small intestine's becoming incarcerated and adherent in this situation. In 2 cases, colostomy in the left rectus muscle was followed by obstruction of the bowels from this cause.

The Mayos have used the *Mixter colostomy* (in the midline just beneath the umbilicus) with satisfaction in a number of cases. It furnishes direct access to the lower sigmoid and rectum, and facilitates cleansing when made as the first stage of a two-stage operation. It also appears to be less liable to late infection in the blind end following the radical operation. Moreover, it rapidly terminates the midline exploration or radical operation by placing the colostomy in the upper end of the working incision and the results are so satisfactory that it is being extensively employed in Mayo's work.

¹ See PROGRESSIVE MEDICINE, June, 1911, p. 129, Fig. 48.

As to the *diet*: Patients are advised to develop the forty-eight-hour habit of bowel movement and to use a large amount of water in emptying the bowel thoroughly once in twenty-four or forty-eight hours.

The Harrison-Cripps Radical Operation, which is applicable only to cancer of the lower rectum and anal canal, gives marvelously good functional results. In those cases in which extensive dissections about the bladder, prostate, urethra, etc., have been made, the return of control of the bladder is sometimes slow.

As to the *permanent cures*. Of the 430 patients subjected to resection, 364 recovered from the operation. Not including those who were operated on less than three years ago, 33.3 per cent. have lived three years or more, and 28.3 per cent. have lived five years or more.

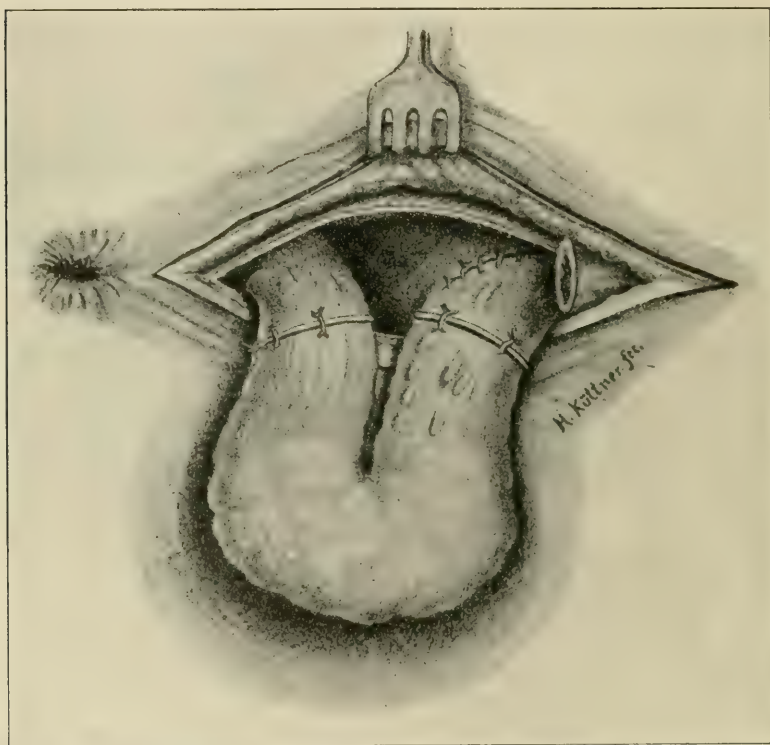


Fig. 63.—Küttner's sacral "vorlagerung." Tumor bearing bowel delivered; circular threads marking points for later amputation.

The sacral "vorlagerung" of carcinomata of the upper rectum was first suggested by Küttner,¹ of Breslau, in 1910. Recently, Küttner² reports that other surgeons, as well as himself, have used this method to their satisfaction. Küttner states that the two greatest dangers following mobilization of the rectum by the perineal or sacral route, are collapse

¹ Deutsch. med. Wchnschr., 1910, No. 13, p. 606.

² Zentralbl. f. Chir., 1916, p. 905.

and gangrene. The essential point of Küttner's operation is the mobilization of the affected portions of the rectum and its deliverance (*vorlagerung*) through the sacral wound. A few days later the diseased portion of bowel is removed, and the two remaining intestinal lumina are united by suture. Formerly, Küttner reestablished the lumen of the intestinal tract by dividing the spur which had been formed. Whereas, at present, in all suitable cases, he reunites the bowel, with a circular suture, immediately after amputation of the diseased portion. The time for this removal of the tumor-bearing portion of the gut is determined by the presence or absence of gangrene. If gangrene sets in, the gut is removed on the day following its *vorlagerung*; if there is no gangrene, the removal takes place on the third or fourth day following the first operation, usually at the end of forty-eight hours. Where gangrene is very

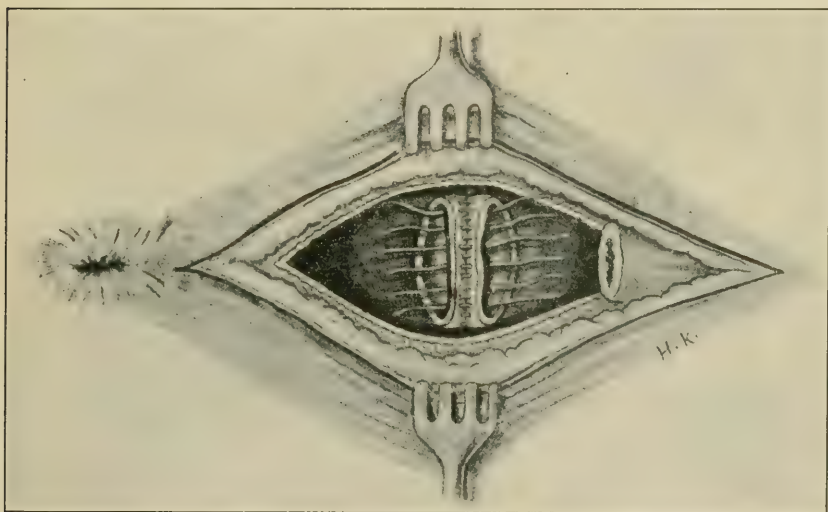


FIG. 64.—Küttner's sacral "vorlagerung." End-to-end suture immediately following amputation at the end of forty-eight hours after initial "vorlagerung."

extensive, the reunion of gut is not feasible, a sacral anus is established and the reestablishment of the intestinal lumen is performed at a later date. Küttner has never observed gangrene to spread as high as the intraperitoneal portion of the gut.

The following details of technic are of interest: Immediately after delivery of the liberated carcinoma with adjacent bowel, two circular marking-threads are placed to mark the site where the gut is to be divided (Fig. 63). These circular threads are held in place by a few interrupted stitches. Fig. 63 shows the tumor and neighboring ducts delivered through the sacral wound. The gut is divided with a sharp knife, not with a cautery. Suture is made with two or three rows of interrupted silk stitches, the anterior wall being united first (Fig. 64). Küttner especially recommends the technical point suggested by Poppert of placing a row of sutures through mucosa and edge of mus-

cularis similar to a Lembert suture of the peritoneum. As a rule, a part of wound has opened, leading to the existence of a fecal fistula for a short time. This fistula usually closes spontaneously. In a few cases primary union was obtained.

Küttner states that this method practically disposes of the dangers of collapse or of gangrene, as the duration of the operation is greatly shortened by not having to establish an artificial anus. As to gangrene, if sufficient mobilization is made, and the isolated duct is packed off so that, in case of gangrene, the gangrenous portion does not come in contact with the healthy wound, the dangers of gangrene are thus avoided. The second stage of the operation, so far as the patient is concerned, constitutes his first dressing. It is done without any narcosis.

Pruritus Ani. H. B. Stone¹ uses 90 per cent. grain alcohol for injection under local anesthesia. After inserting the needle, pass it parallel to the skin superficially so as to paralyze the sensory nerves and avoid paralysis of the motor branches. As just said, if a local anesthetic is used, 90 per cent. alcohol is injected; if a general anesthetic is used, 70 per cent. Nothing less than 70 per cent. is effective. There have been two bad sloughs the size of a ten-cent-piece and a silver quarter, eight to ten as large as a grain of wheat, with no incontinence. If one should err it should be toward the slough. The patients were completely relieved. One recurred in about a year and was reinjected. They should be kept under observation for about ten days to see that no complication occurs.

LIVER AND BILE PASSAGES.

Anomalies of the Gall-bladder and Bile Passages have been classified in a rather exhaustive article by Schachner.² Among other points of interest are the following: A *double gall-bladder* is one in which each gall-bladder has its independent cystic duct, thus separating it from a bifid gall-bladder in which the cavities are distinctly separate, but communicate with the common duct through a single cystic duct. Five cases of double gall-bladder are recorded. In a *bilobed gall-bladder* the cavity consists of two lobes with a single cystic duct. In a *diverticulum of the gall-bladder* there is one large cavity and a smaller recess communicating with the larger or true gall-bladder. Of the 7 cases reported, 5 were simple and 2 were complicated. Of these, there was a division of the common duct just beyond the entrance of the cystic duct.

There are 16 cases of *intrahepatic gall-bladder* noted. A *left-sided gall-bladder* occupies the position to the left of the falciform ligament in a normally placed liver. Of 13 cases reported, 6 were complicated, and 7 were uncomplicated. A left-sided gall-bladder may be concealed behind the falciform ligament and at operation may be overlooked entirely or confused with a congenital absence, extreme fibrosis or an intrahepatic gall-bladder. Eight cases of floating gall-bladder are recorded. *Absence of gall-bladder* was reported in 7 cases. Two of these

¹ Journal of American Medical Association, vol. lxvii, p. 1787.

² Annals of Surgery, October, 1916, p. 419.

were complicated by the absence of the quadrate lobe of the liver. Incidentally, absence of gall-bladder is common in some animals, such as the elephant, rhinoceros, camel, goat, deer, some species of fish, some birds and some rodents (Eschner).

An Idiopathic Choledochus Cyst, is reported by Russell Fowler.¹ There were 19 other cases in the literature. In Fowler's case the common duct was dilated to the size of a large orange and had the appearance of a cyst. After operation, the stools were clay-colored and all the bile escaped through the wound. The bile was strained and injected by rectal tube into the colon where it was moderately well tolerated. The patient gradually lost strength and died twenty-two days after operation. (It was a pity that of the collected bile feeding by stomach or duodenal tube was not attempted in this case.—REVIEWER.)

Seeliger² had a similar case in a girl, aged thirteen years. At the primary operation, the cyst was considered to be of pancreatic origin; it was marsupialized. Four days later it was incised; the cystic and hepatic ducts entered the cyst at different points in its wall. There was a thinned-out spot in the cyst wall where it lay against the duodenum; this was perforated with a blunt instrument, thus establishing a communication with the gut. The patient died six days later.

Calcified Lymph Nodes Adjacent to the Common Bile Duct are sufficiently rare to justify mention. A case of this sort was spoken of last year and recently another has been reported by Russell S. Fowler,³ in a man, aged thirty-two years. Clinically, the case was one of cholecystitis. At operation, the gall-bladder was distended but apparently normal. A cysticoduodenal ligament was present. A hard mass about the size of a filbert, thought to be a stone, was palpated at the lower part of the middle portion of the common duct. The tissues over this mass were incised and a mass of calcified material exposed. Following the removal of this, there was no discharge of bile. It was then suspected that the material came from a calcified gland. A second, smaller gland, also calcified, was discovered lying below the first behind the duodenum. This was also removed. The gall-bladder was then opened. The mucosa showed moderate chronic catarrh.

Adenomyoma of the Common Duct causing obstruction is reported Mertens and Stahe.⁴ The tumor was 14 mm. long and 5 to 6 mm. thick, and was situated on the posterior wall of the common duct.

Biliary Peritonitis without Perforation of the Bile Passages has been referred to in previous reviews. Axel Blad,⁵ of Copenhagen, has done some experimental work upon this subject, using 16 dogs. According to Blad, if pancreatic ferments make their way into the bile passages, a condition which is especially apt to occur immediately after the passage of gall-stones, the trypsin becomes activated in the bile passages and begins to digest the tissue. Experiments with dialysis tubes showed that

¹ *Annals of Surgery*, November, 1916, p. 546.

² *Brun's Beiträge*, Band xcix, Heft 1, p. 158.

³ *Surgery, Gynecology and Obstetrics*, December, 1916, p. 718.

⁴ *Deutsch. Ztschr. f. Chir.*, Band cxxxv, p. 565.

⁵ *Zentralbl. f. Chir.*, 1916, p. 865.

when the colloid bile is digested, pigment is set free and is actively dialyzed through the pores. Pancreatic juice was injected into the gall-bladder, either transhepatically or from the duodenum, and then the common duct was ligated. Subsequently, a peritonitis was found, with bile pigment in the lower part of the abdomen without any ascertainable perforation. Macroscopically, the gall-bladder showed nothing, whereas under the microscope a total destruction and softening of its walls was found.

In the discussion, Ingebrigsten asked whether the tinging of the peritoneal exudate might not be the results of the generalized icterus. To this Blad replied that in a few cases there was a marked icteric coloring of the peritoneal exudate long before icterus became marked. In still another case there was a local peritonitis in the upper part of the lower abdomen with biliary pigmentation of all the intra-abdominal organs, but no general icterus.

The Relation of Hypercholesterinemia to Gall-stones was discussed last year¹ giving the views of M. A. Rothschild. Henes, another worker in this field, brings out ideas which largely coincide with those of Rothschild but differ in some important particulars. Both authors agree that hypercholesterinemia is present in pregnancy, arteriosclerosis, chronic nephritis, jaundice, etc., and that the normal cholesterinemia is between 0.12 and 0.18 gram per cubic centimeter.

Henes emphatically states that the cholesterin content of the blood is always reduced by fever.

In 1 case Henes states that the serum cholesterol amounted to only 0.00177 gram per cubic centimeter, yet at operation the gall-bladder was full of small stones, nevertheless in another place he says: "In no case of cholelithiasis verified by operation, did the blood fail to show a hypercholesterinemia."

While we readily concede that the presence of a hypercholesterinemia in the absence of such diseases, as arteriosclerosis pregnancy, jaundice, nephritis, etc., and in conjunction with a clinical history, is strongly suggestive of cholelithiasis, yet a low cholesterin figure does not mean the absence of gall-stones (as said last year).

A clinical study of the subject (cholesterin as a factor in cholelithiasis) was made by De Langen,² in Holland and in the Dutch East Indies. He has shown that there is a marked difference between Europeans and natives of that region. In the latter the cholesterin content of blood is only about half of that in Europeans, while the cholesterin content of the bile is also low. De Langen also noticed the extreme rarity of gall-stone trouble in the East Indies and when such rare stones are found they are not the cholesterin stones of Europe but are composed principally of calcium bilirubinate. Diabetes mellitus was also very rare, and arterial pressure is low among the natives of the Dutch East Indies. He does not state whether the physiological hypocholesterinemia is the result of diet, of racial peculiarity, or whether this low cholesterin content has anything to do with beri-beri. (In all probability the natives of Java eat very

¹ PROGRESSIVE MEDICINE, 1916, pp. 163 to 167.

² Presse Médical, July 27, 1916, p. 332.

little meat, lipoid-containing substance, and consequently this would account for their low cholesterin.—REVIEWER.)

Intrahepatic Cholelithiasis. Lewisohn¹ reports a case of this extremely rare condition in a man, aged thirty-one years. The pre-operative diagnosis was acute gangrenous cholecystitis, or a perforated duodenal ulcer. At operation, there was much free, yellow, turbid fluid in the upper abdomen. The liver was enlarged to about one and half times its normal size and there were extensive adhesions between its upper surface and the diaphragm. This surface was covered with a coating of fresh fibrin. The whole diaphragmatic surface of the liver felt nodular. The

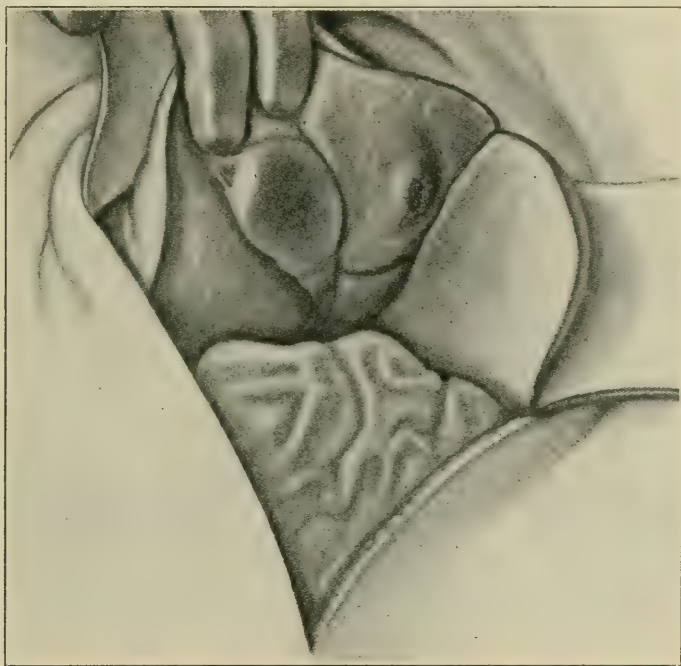


FIG. 65.—Perforation of intrahepatic stones at under surface of the liver, causing a localized peritonitis. (Lewisohn.)

areas were hard and some of them were whitish in color. On the inferior surface of the liver toward the anterior lobe there was an inflamed area belonging to the right lobe in which was seen a small abscess cavity which had perforated and opened into the free peritoneal cavity. At the base of the cavity two small gall-stones were felt; the liver tissue was incised and the stones removed (Fig. 65). The wound was closed with chromic gut. The stones were small and black. The site from which they were removed was more than an inch and a half to the left of the gall-bladder's attachment. The nodular diaphragmatic surface of the liver was then exposed and one of these nodules of the right lobe—about four inches from the anterior free border—was incised; after

¹ *Annals of Surgery*, May, 1916, p. 535.

splitting the capsule a small nodule was enucleated. From the center of this four small black gall-stones were removed similar to those obtained

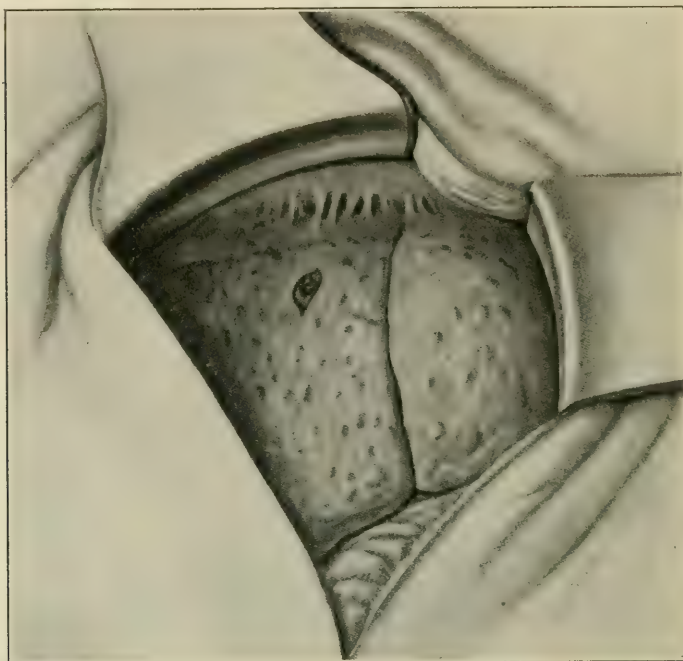


FIG. 66.—Removal of intrahepatic stones from diaphragmatic surface of the liver. (Lewisohn.)

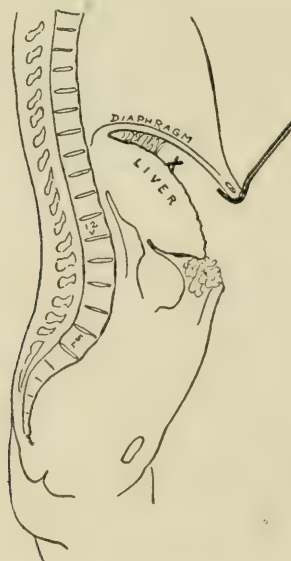


FIG. 67.—Diagrammatic side view X, removal of intrahepatic stones from the diaphragmatic surface of the liver. (Lewisohn.)

from the under surface of the liver (Figs. 66 and 67). The gall-bladder contained about 30 c.c. of turbid fluid and 6 yellowish gall-stones. The yellowish color of these stones was in contrast with the black color of the intrahepatic stones. In short, there was a condition of intrahepatic cholelithiasis with a spontaneous perforation of intrahepatic stones at the under surface of the liver causing a localized peritonitis.

In a brief resumé of the literature, Lewisohn reports that the condition has been observed two hundred and fifty times, mostly at post-mortem. He refers to the work of Beer, published in 1904, in which 6 cases of intrahepatic cholelithiasis were observed at autopsy in a series of 250 patients dying from gall-stone disease. According to Beer, there are three etiological factors to be considered in the formation of intrahepatic stones. (1) obstruction; (2) cholangitis; and (3) an unknown factor (diathesis?). Obstruction and cholangitis alone, cannot explain the picture of intrahepatic cholelithiasis, for intrahepatic stones are as a

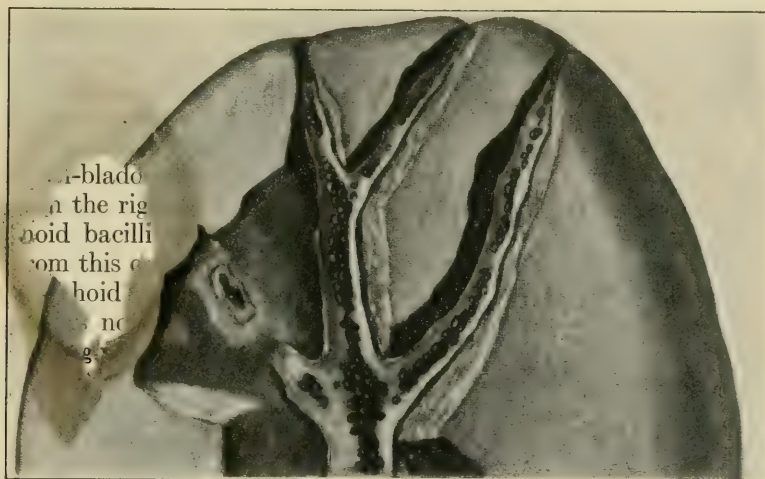


FIG. 68.—Postmortem specimen illustrating intrahepatic cholelithiasis. (Lenhartz.)

rule not found in complete obstruction of the common duct by a tumor at Vater's papilla though a secondary cholangitis is very often present in these cases. We must therefore assume a third factor for the causation of intrahepatic stones.

A great deal of discussion has dealt with the question of whether these stones are formed in the liver or whether they are formed in the gall-bladder and have later wandered upward into the liver. Beer has pointed out that intrahepatic stones differ in shape, color and character, from the stones found in the gall-bladder and that it is therefore impossible to assume that the intrahepatic stones have originally been formed in the gall-bladder. The findings in Lewisohn's case confirm this view. The stones removed from the hepatic duct differed absolutely from those found in the gall-bladder. In Lenhart's case, one of the most typical cases of intrahepatic cholelithiasis (observed at postmortem), the gall-bladder did not contain any stones (Fig. 68). Lewisohn therefore

considers it beyond doubt that intrahepatic stones can be, and are, formed in the liver.

In Lewisohn's case, a biliary fistula which persisted for eight months closed spontaneously and remained closed for four months, although the hepatic duct and probably the common duct also, were filled with stones.

The Relation of Gall-stones to Diabetes. Case,¹ of Battle Creek, Mich., made x-ray studies of the gastro-intestinal tracts in 72 cases of diabetes. He found that gall-bladder involvement was very common, especially gall-bladder lesions attended by pericholecystitic adhesions. There seemed to be a striking relationship between the severity of the diabetes and the degree of ileac stasis. Ileocecal valve incompetency was a common finding in diabetics, but Case could not discover any definite relationship between the degree of incompetency and the severity of the disease. Extreme colonic stasis was only present in two, and in both of these there was a carcinoma of the distal colon.

Pathogenesis of Gall-bladder Infection. Nichols's² experiments seemed to support the theory of descending infection of the gall-bladder by the bile from the liver. The bile ducts seemed to be the regular avenue of infection although infection of the gall-bladder wall could not be absolutely ruled out.

Rosenow³ speaks of the mechanism of the relation between cholecystitis and gall-stones as the result of his studies upon material removed at operation in 47 cases. The fluid contents of the gall-bladder was cultured in 29 cases, 13 were sterile and in the remaining 16, streptococci were found—sometimes in conjunction with the colon bacillus (15 cases), and in others with other bacteria (2 cases). The colon bacillus was found in pure culture four times. Gall-stones were cut open and cultures were made from their nuclei. These were sterile in 33 instances, and in the remaining 29, the streptococcus was isolated in pure culture in 17, and the colon bacillus in pure culture in 1. The remainder were mixed infections of streptococcus with colon bacillus and with other bacteria. Cultures made from 4 typical cholesterol stones showed no streptococci; 2 were sterile, 1 yielded a few colonies of a diphtheroid bacillus and 1 the colon bacillus. Of 32 cultures from the wall of the gall-bladder, 5 were sterile; of the remaining 27, the streptococcus were found in pure culture in 10, the colon bacillus in 1; in 1, mixed infection of colon bacillus; and streptococcus in 8; and streptococcus with other bacteria in 3.

In a number of cases the fluid contents of the gall-bladder was sterile and yet streptococcus was isolated from the wall of the gall-bladder (in 8) and from the center of gall-stones (in 6) and from the adjacent lymph glands which were cultured (in 8 cases); 1 was negative and 4 showed pure cultures of streptococcus, 1 streptococcus and a diphtheroid bacillus, and 1 a pure colon bacillus. Other bacilli (*Bacillus welchii*,

¹ Journal of American Medical Association, vol. lxvii, p. 858.

² Journal of Experimental Medicine, November, 1916, p. 497.

³ Journal of Infectious Diseases, October, 1916, p. 537; Journal of American Medical Association, vol. lxvii, p. 1183.

Staphylococcus aureus, diphtheroid bacilli, fusiform bacilli, *B. mucosus* and typhoid bacillus) were occasionally found.

Rosenow's studies bring home the point that the gall-bladder should be removed instead of drained, especially in the absence of stones with a chronic cholecystitis, so that the latent infection cannot flare into activity when the defensive mechanism of the individual is low. Not only must there be microorganisms present for the formation of stones (for they are found in the centers of gall-stones; gall-stones are frequently present in streptococcus infection of the gall-bladder and the streptococci are found in these newly formed stones), but a high cholesterol content of the bile is necessary in addition.

The Duodenal Tube as a Means for Studying the Bacteriology of the Bile in Typhoid Carriers. Garbat¹ makes the logical suggestion that isolation of typhoid bacilli from bile obtained by means of the duodenal tube was a much simpler matter than from stools.

Labbé and Canat² used this method in a series of 35 patients ill with typhoid or paratyphoid. Cultures from the duodenal bile were positive in 43 per cent., while those from the stools were positive in only 36 per cent.

Removal of the Gall-bladder in Typhoid or Paratyphoid Carriers. Nordentoft's³ patient had an acute perforating cholecystitis for which the gall-bladder was removed. Later on, there were new attacks of pain in the right hypochondrium, with jaundice and high fever. Paratyphoid bacilli were again found in the stools.

From this case it is evident that although some subjects cease to pass paratyphoid bacilli in their stools and urine after cholecystectomy, this does not always follow.

The Significance of Turbid Bile Obtained by the Duodenal Tube from a Fasting Subject. According to Einhorn, in the majority of cases in which turbid bile is found in the duodenum (by duodenal tube) in the fasting condition, cholecystitis with gall-stones is encountered. However, turbid bile may exist without gall-bladder disease when the liver itself is seriously diseased (neoplasms or echinococcus of the liver or high-grade cirrhosis) or in stricture of the duodenum below the papilla of Vater. However, clear bile may exceptionally be found in the presence of biliary calculi.

Cholecystectomy versus Cholecystostomy are treated in the recent papers of Lund and of Guthrie. Both reach very much the same conclusions.

Lund⁴ considers that in the absence of jaundice, the supposed necessity for draining of bile is an error, the common duct being clear and bile passing freely into the duodenum. The need of the gall-bladder for duodenostomy, the presence of common duct stricture, or pancreatitis, is an argument in favor of its retention and is a good reason for not performing cholecystectomy where such conditions are likely to develop. According to Lund, the indications for cholecystectomy are the following:

¹ Journal of American Medical Association, vol. lxvii, p. 1492.

² Paris Médical, January 20, 1917, p. 57.

³ Hospitalstidende, May 10, 1916, p. 441.

⁴ Boston Medical and Surgical Journal, 1916, p. 909.

1. The presence of acutely inflamed or gangrenous gall-bladders due to the stone infection in the common duct.

2. Chronic thickened gall-bladders.

3. Gall-bladders very much distended with clear fluid due to impaction in the cystic duct.

4. Malignant disease.

5. Chronic cholecystitis without stones, but with moderate thickening and ulceration—the so-called strawberry gall-bladder.

6. Chronic cholecystitis without stones, but with adhesions of the surrounding organs resulting in crippling of the latter with the production of symptoms.

In Guthrie's¹ paper the question of cholecystectomy *versus* cholecystostomy has been brought up to date in a clear summary, as a result of his own experience and from replies to his questionnaire by the leading surgeons of this country.

According to Guthrie, reports show that recurrences occur in 9.5 per cent., of cases with previous cholecystotomy. The recurrences following cholecystectomy are much fewer, the exact percentage is not known. Cholecystectomy is performed now more frequently than in the past and is a better operation, but it is attended with many more technical difficulties and dangers than simple drainage. Provided the patient's condition will permit, the gall-bladder should be removed when its wall is diseased or the patency of the cystic duct is in doubt. Contra-indications for cholecystectomy are, a critical state of the patient, acute empyema, infection of the ducts and pancreatitis where drainage is desired. Guthrie believes it safer to drain an acute empyema of the gall-bladder and to explain to the patient that a second operation may be necessary. He considers the two-stage procedure a safer one than a removal, for empyema of the gall-bladder, especially by those inexperienced in gall-bladder surgery.

In the discussion, Deaver concurred with Guthrie.

Temporary Biliary Fistula after Operations upon the Stomach. McArthur² reports that during the past two years, in the majority of his gastric operations, he has established a biliary fistula, as during the early postoperative hours the bile being allowed to escape externally fails to disturb the more or less parietic stomach. He establishes this temporary biliary fistula in a normal gall-bladder and brings out the tube either through the abdominal wound or through a separately placed stab wound.

TRANSVENTRICULAR CHOLEDOCHODUODENOSTOMY was performed by Colmers³ upon a patient, aged sixty-one years, suffering from a common duct obstruction.

The gall-bladder was found filled with stones. The common duct obstruction was due to a tumor the size of a walnut in the head of the pancreas. After removal of the common duct, it was determined to

¹ Journal of American Medical Association, vol. lxvii, p. 653.

² Lancet, December 15, 1916, p. 723; Journal of American Medical Association, vol. lxviii, p. 67.

³ Zentralbl. f. Chir., 1916.

establish a choledochoduodenostomy. Instead of a simple union by a suture, a small incision was made in the anterior wall of the stomach, and, through this, a long, thin, rubber drainage tube was introduced into the stomach and through the pylorus down into the duodenum. Upon the point of the clamp the duodenal wall was incised and the rubber drainage tube was drawn through, out of the opening of the duodenum and introduced into the common duct through a small opening in it. After this, the walls of the common duct and duodenum were united by suture and the drainage tube was led out through the stomach wall, and a Witzel gastrostomy was established at the point where the drainage tube emerged from the stomach wall. A lateral fenestra was established in that part of the tube lying within the stomach and pylorus, to permit of some partial escape of bile into the intestinal canal. Uneventful recovery ensued, the drain being removed on the tenth day. Icterus subsided and the stools were colored. The patient was well seven months after operation. Colmers believed this method of drawing the biliary drainage into the stomach is less apt to be followed by a biliary fistula than the usual, well-accepted method of drainage of the common duct.

TRANSPANCREATIC CHOLEDOCHOTOMY. Harrigan reports a case in which palpation through the duodenum disclosed a calculus in the terminal part of the common bile duct which resisted all efforts to displace it upward into the supraduodenal part. As he was holding the duodenum forward on his finger, he indirectly lifted up the pancreas, the idea came to reach the stone through the pancreas. A small opening was made in the pancreas and the stone was readily exposed. The duct wall was incised when the supporting hand slipped. However, two more stones lying immediately above appeared in the wound and were easily removed.

A search through the literature revealed that the operation had been performed three times previously, namely by Tansini, Ferrier and McGraw. Harrigan refers to the anatomical studies of Quenu describing the retroduodenal or pancreatic part of the common bile duct. It measures 20 to 25 millimeters in length and it traverses a quadrilateral whose borders are formed above, by the inferior border of the first part of the duodenum; below, by the superior border of the third part of the duodenum; externally, by the inner border of the second part; and internally by the superior mesenteric veins. According to Testut, the course of this portion of the duodenum is indicated by an oblique line starting from the inner one-third of the inferior border of the first part of the duodenum and ending in the middle of the inferior border of the second part of the duodenum. This anatomical quadrangle plays an important part in the operation to be described, *i. e.*, transpancreatic choledochotomy. In this quadrilateral space, as one approaches the duodenum the thickness of the pancreatic tissue in front of the common bile duct diminishes from above downward. At the inferior border of the first part of the duodenum, it is 14 to 15 mm. thick, whereas at the middle, the pancreatic tissue measures 10 mm., and at the border of the second part of the duodenum no more than 5 or 6 mm.

Harrigan's scholarly article includes a consideration of Kocher's retroduodenal choledochotomy and McBurney's transduodenal operation. As to transpancreatic choledochotomy, the three objections, namely, injury to the duct of Wirsung, pancreatic fistula and the occurrence of severe hemorrhage, are sufficiently real to prevent the selection of the transpancreatic route except when the retroduodenal or transduodenal routes are not available.

CHANGES IN THE BILE DUCTS AFTER REMOVAL OF THE GALL-BLADDER. According to Judd,¹ of the Mayo Clinic, the ducts dilate, the greatest amount of dilatation being in the hepatic duct. This stops short at the surface of the liver and does not involve the pancreatic duct. Judd believes the dilatation is due to the resistance of the sphincter at the ampulla of Vater.

RECURRENCE OF GALL-STONES AFTER INCOMPLETE REMOVAL OF GALL-BLADDER. Six years after a cholecystectomy the patient returned with renewed symptoms of cholelithiasis. Kadian² found a newly formed gall-bladder continuous with the common duct. The bladder contained ten cholestrin stones. Kadian himself advocates ligation of the cystic duct close to the common duct in order to avoid formation of a diverticulum which might enlarge itself to the size of a new gall-bladder.

Bile-duct Reconstruction. **REPAIR OF THE INJURED COMMON BILE DUCT BY AUTOGENOUS FASCIAL TRANSPLANT** is reported by Ginsburg and Speese.³ In the course of a cholecystectomy performed in the retrograde fashion, the common duct to which the cystic duct was parallel was caught in the forceps applied to the cystic duct and both structures were divided. This was ascertained only at examination of the gall-bladder and cystic duct just after operation. Nine days after the first operation the distal and proximal ends of the common bile duct were isolated. The division had taken place half a centimeter below the junction of the right and left hepatic ducts. Apposition of the divided ends was impossible, consequently a T-shaped rubber tube was inserted into the proximal and distal ends of the bile duct and was fixed by catgut suture. The two-inch defect was then covered over with a tube of fascia from the posterior rectus sheath including peritoneum. For one week after operation the stools were bile-stained but afterward they became clay-colored. Three weeks later the patient was up and about with the T-tube in place draining freely into a bottle. He was kept on a meat-free diet. There was complete acholia and the daily amount of bile escaping from the fistula amounted to between 10 and 12 ounces.

At a third operation, nine weeks later the reconstructed bile duct was exposed, and examination showed that the distal end of the T-tube had broken away at the junction of the fascial transplant with the distal end of the common duct and this was impinging upon the wall of the

¹ Boston Medical and Surgical Journal, 1916, p. 815.

² Abstracted from *Russkiy Vrach*; Journal of American Medical Association, vol. lxvi, p. 1666.

³ *Annals of Surgery*, January, 1917, p. 79.

duodenum. A curved forceps was passed through this portion of the duct into the duodenum and no obstruction was found. The T-tube was removed, bile flowing freely. A small, thick-walled rubber tube slightly less in diameter than the common duct was substituted for the T-tube and the bile duct reconstructed around this tube.

Three months later, at a fourth operation (performed for upper abdominal distress following ingestion of food), the rubber tube was found in the common duct. The duodenum was opened about one inch from the pylorus but the rubber tube could not be felt in the duodenum and its removal was not attempted. Up to the present time the rubber tube is still being retained.

Ginsburg and Speese, in discussing the various methods for reconstruction and repair of the common bile duct, state that the operation of Walton¹ can be much improved by cutting the duodenal flap with a pedicle above, instead of below, and placing it behind the rubber tube employed for reconstruction, so that the suture line will be on the ventral surface of the rubber tube instead of on its posterior aspect. This variation in technic will make the operation easier, and the new suture line can be reinforced by grafts of omental tissue. The blood supply of the duodenal flap having its pedicle above, will be more abundant since the superior duodenal border is richly supplied by branches of the upper pancreaticoduodenal artery.

In the discussion, Jopson reported end-to-end anastomosis of the common bile duct with chromic catgut following injury during resection of stomach for carcinoma. The man was in good health thirteen months later.

P. G. Skillern questioned the permanency of the lumen of this artificial bile duct for the fundamental reason that operators fail to provide an epithelial lining for the duct and he feared subsequent stricture formation. For this reason, Walton's method of reconstruction appealed to him because it lined the tract with mucosa.

In his article on end-to-end suture of the bile ducts, Riggs refers to the paper of J. H. Jacobson,² of Toledo, Ohio, also dealing with repair and reconstruction of the bile ducts. According to Jacobson, who managed to collect 34 cases, in 90 per cent., there was accidental injury to the bile ducts. This finding should serve to emphasize the frequency of atypical implantation of the cystic duct as well as the necessity for extreme care in performing cholecystectomy.

ANOTHER METHOD OF VENOUS ANASTOMOSIS (ECK FISTULA) FOR RELIEF OF PORTAL OBSTRUCTION CONSEQUENT UPON HEPATIC CIRRHOSIS was devised by Jeger³ who, during the siege of Pzemysl, worked out the following operation upon 20 cadavers. The main branch of the superior mesenteric vein was joined side-to-side with the inferior vena cava. In 16 of the 20 cadavers, this was technically feasible. In 3, however, the distance between the two veins was too great to permit approximation without tension. In these, a section of internal jugular

¹ Reviewed in *PROGRESSIVE MEDICINE*, June, 1916, pp. 185 and 186, Figs. 85 and 86.

² *American Journal of Obstetrics*, New York, 1914, vol. lxx, No. 6.

³ Brun's *Beiträge*, 1916, Band xcix, p. 94.

vein was used to establish communication between the vena cava and the superior mesenteric end, end-to-side union in both cases. In a final case, the duodenum was so low down that, after suture of the two vessels, a constriction of its transverse portion was noticed. Hence, Jager suggests that a Murphy button gastro-enterostomy be added. The operation was repeated upon two dogs, who have showed no ill-effects so far.

CARCINOMA *versus* CHRONIC INFLAMMATORY CONDITIONS OF THE BILE PASSAGES. Kahr¹ reports one permanent cure in 49 cases of primary carcinoma of the gall-bladder. In this single case the gall-bladder had been removed for chronic inflammation, and only after microscopic examination was the existence of carcinoma realized. Kahr's experience coincides with those reported in the literature from which he was able to collect 350 operations for carcinoma of the gall-bladder, with a permanent cure known in only 2.3 per cent. Kahr points out that the combination of a hard, knobby tumor of the gall-bladder region with ascites, cachexia, and jaundice may be mistaken for carcinoma, and thus operative treatment be refrained from when the condition may be entirely due to gall-stone trouble, and the patient may eventually die from this benign affection. Pain is no criterion. It may occur in benign, as well as in malignant, affections.

PANCREAS.

Ascaris Pancreatitis. Izumi² was able to find but 2 published cases of chronic pancreatitis of parasitic origin, 1 from Japan and the other in a cat, reported by Ordway. Izumi himself reports 4 cases, with pains in the pancreatic region and other symptoms, which led eventually to the removal of part of the pancreas. The ova of ascaris were found imbedded in a circumscribed inflammatory process. In one case, a long female ascaris was found in the pancreatic duct. The stomach, liver, and biliary ducts were apparently normal in each instance.

Izumi reports experiments on 9 dogs injected with an emulsion of ascaris ova into the pancreas, with control injections of isotonic salt solution. Those injected with ascaris eggs developed a chronic circumscribed pancreatitis. No fat necrosis was found in these animals, although it was pronounced in the clinical cases. In further investigations on the origin of acute hemorrhagic pancreatitis in ninety-six dogs, extensive research confirmed the fact that the trypsinogen element of the pancreatic juice was responsible for the acute hemorrhagic process; however, it first had to be activated; an extract of duodenal mucosa was the most potent activator. All other factors seemed to be of minor importance.

Pancreatic Cyst a Cause of Unilateral Hematuria is reported by Ransohoff.³ A man, aged sixty-one years, gave a history of illness three years

¹ Berlin. klin. Wehnschr., November 8, 1915.

² Mitt. a. d. Med. Fak. Kyushu Univ., Japan; Journal of American Medical Association, vol. lxvii, p. 1480.

³ Surgery, Gynecology and Obstetrics, March, 1916, p. 75.

before, beginning with violent abdominal pain in the region of the umbilicus. Two years later he had a similar attack. A few months later, his family physician recognized a tumor in the left upper quadrant of the abdomen. Shortly after this he came to Ransohoff on account of passing large quantities of blood with the urine. Physical examination showed a tumor in the left upper quadrant the size of an adult hand. Operation revealed this to be a pancreatic cyst, which was opened and drained. The hematuria subsided after operation. The patient, however, died of pulmonary infection seven weeks after operation. Ransohoff attributed the hematuria to pressure on the left renal vein, pointing out that pressure on the splenic vein caused enlargement of the spleen to four or five times its natural size.

Good Metabolic Function after Extensive Pancreatic Destruction. Miller,¹ reports the case of a man, most of whose pancreas was destroyed by an acute pancreatitis. There was a very large slough of the pancreas. He recovered and enjoyed perfect health, and, three years later, a study of his digestion and sugar metabolism showed practically no variation from the normal in spite of the fact that he had been in the habit of taking large quantities of alcohol and had established a habit of eating four or five very large meals a day.

SPLEEN.

Hemolytic Jaundice. RELATION OF THE SPLEEN TO HEMOLYTIC JAUNDICE. In studying the question of whether or not the lessened tendency to jaundice after splenectomy is due in part perhaps to the blood supply to the liver, Austin and Pepper² introduced hemoglobin into the femoral veins of some animals and into the mesenteric vein of others. It was noted that the resulting jaundice was distinctly more persistent after mesenteric than after femoral injection. They explain this as follows: When the hemoglobin is set free in the portal circulation, a larger amount is held by the liver and converted rapidly into bile pigment than is the case when it is set free in the general circulation. Through the direct portal path the overloading of the liver may thus occur more readily, and jaundice is more apt to develop.

Krumbhaar, Musser, and Peet³ diverted the venous outflow of the spleen by either ligating the splenic vein or implanting it into the vena cava instead of removing the spleen. Animals with transplanted splenic circulation showed a lessened tendency to jaundice similar to that exhibited after simple splenectomy. Thus, the altered course of the blood supply to the liver had a distinct effect upon the intensity of the jaundice.

Balfour⁴ points out that it is very difficult to produce toxic jaundice in spleenless dogs by those poisons which readily produce it in normal dogs. Thus, after the administration of toluylendiamin the bile remains

¹ *Annals of Surgery*, September, 1916, p. 329.

² *Journal of Experimental Medicine*, 1915, p. 675.

³ *Ibid.*, 1916, pp. 87 and 97.

⁴ *Journal of American Medical Association*, vol. lxxvii, p. 790.

thin and green, while in non-splenectomized dogs it becomes viscid. Stadelmann was the first to attribute acholuric jaundice to this thickening of the bile, which delays, by very reason of its viscosity, its own passage through the finer bile capillaries.

Speaking of hemolytic icterus, Miller¹ says: Probably too much stress has been placed on the benign character of the affection. As the majority of these patients suffer from anemia and consequent lowering of their efficiency, especially following a hemolytic crisis, the occurrence of which is so common in these cases, the degree of anemia may be so great as to temporarily incapacitate the individual. When considering the advisability of splenectomy the degree of inconvenience caused by the malady should be seriously considered, as the operation is attended with a certain amount of danger and should not be undertaken without definite indications.

As to splenectomy for Hanot's cirrhosis, Eppinger's cases reported in 1913, and 4 by Mayo recently reported are the only ones in the literature. (See below.)

RECOVERY FROM HEMOLYTIC ICTERUS AFTER X-RAY TREATMENT OF THE SPLEEN. Jona's² patient was a male, aged eighteen years. While splenectomy was being considered, röntgenotherapy was tentatively applied to the spleen. After twenty-one exposures in forty-three days, the patient considered himself cured, and there has been no sign of recurrence during the past three years. Jona also cites 2 cases reported by Parisot, in 1913, in which marked improvement followed exposure of the spleen to the Röntgen rays; both were cases of hemolytic icterus. These were cases of congenital hemolytic icterus while Jona's patient was one of acquired hemolytic jaundice. He therefore recommends a thorough trial of röntgenotherapy before resorting to splenectomy in all of these cases.

Splenectomy for Splenic Enlargement in Portal Cirrhosis. In speaking of splenic enlargement associated with hepatic disease, Mayo³ says: "The common forms of cirrhosis of the liver may be divided into three classes: (1) portal cirrhosis, in which the toxic material obtains entrance through the portal system and a connective-tissue proliferation advances from the portal spaces, and in which the symptoms are those of portal obstruction; (2) biliary cirrhosis, in which the infective agent may be either ascending from the biliary sac or hematogenous, and in which the most pronounced clinical sign is chronic jaundice, while portal obstruction occurs late; (3) mixed types which are undoubtedly not rare, and in which a pre-operative diagnosis is often impossible. In 4 instances splenectomy was done for splenic enlargement in portal cirrhosis. Three were markedly improved, the ascites and anemia having disappeared."

In speaking of

Splenectomy for Splenic Anemia, J. L. Miller,⁴ says: "The classification of all splenic tumors with chronic anemia under the general head of

¹ Journal of American Medical Association, vol. lxvii, p. 727.

² Polyclinico, Roma, 1916, Medical Section, No. 1; Journal of American Medical Association, vol. lxv, p. 696.

³ Journal of American Medical Association, vol. lxvi, p. 716.

⁴ Ibid., vol. lxvii, p. 727.

splenic anemia may not be logical, but, from a therapeutic point of view, such a grouping may be desirable, as there is indisputable evidence that cure has been effected in the vast majority of patients clinically diagnosed as having splenic anemia on whom splenectomy was performed. Even when the disease had advanced to the point of marked hepatic cirrhosis and ascites, more or less complete return to normal has been reported."

Splenectomy for Syphilitic Splenomegaly. According to W. J. Mayo¹ "The splenomegaly sometimes found in patients with syphilis and usually associated with syphilis of the liver, apparently has a definite relationship with the chronic anemia of secondary type which is present." This anemia has promptly been relieved by splenectomy in a few cases on record and in 3 patients of the Mayos. They all had splenomegaly, a history of syphilis not responding to treatment, positive Wassermanns, and marked anemia. Previous to operation, however, a negative Wassermann could be obtained under antisppecific treatment but became positive as soon as this was discontinued. All of the patients had gummata in the liver, and, in the spleens removed, spirochetæ in large numbers. Removal of the spleen, followed by antisppecific treatment, resulted in prompt and permanent relief.

Splenectomy for the Control of Gastro-intestinal Hemorrhages is suggested by Balfour as the result of his experience with the following case:

A man, aged forty-five years, was admitted to the Mayo Clinic complaining of having bloody stools. After careful examination, a diagnosis of duodenal ulcer was made. Operation was considered urgent on account of repeated hemorrhages and marked anemia. At the first operation the pyloric end of the stomach was markedly dilated and enormous varicose veins were present in this part of the stomach. Several of the large veins on each side of the pylorus were also ligated. He made a successful recovery but hemorrhages continued. At a second operation, two months later, a posterior gastro-enterostomy was done on the assumption that bleeding was due to erosion of the gastric mucous membrane; he improved somewhat, but his bleeding continued, so that he was reoperated on six months later. A thickening on the anterior aspect of the gastric side of the gastrojejunal opening was found which was looked upon at the time as an ulcer. This was excised by the Paquelin cautery and closed by suture. Incidentally, an entero-anastomosis was established between two loops of intestine, combined with a jejunostomy. In spite of this, the hemorrhages continued. Finally, the persistency of the hemorrhages and the fact that the spleen had been proved responsible for certain types of anemia associated with hemorrhage of the mucous membrane led to the idea of splenectomy, although no enlargement of the spleen had been previously noted. Accordingly, a spleen of about twice the normal size was removed. Recovery following this was slow but steady, and at the present time, seven months after operation, the patient is in better health than he had ever been.

This case report is extremely suggestive.

¹ Journal of American Medical Association, vol. lxvi, p. 716.

Splenectomy for Pernicious Anemia. A symposium on pernicious anemia was held at the Detroit meeting of the American Medical Association in Detroit last June. The most important points brought out are given below.

According to Lee, Minot and Vincent,¹ of Boston, in 15 cases of pernicious anemia with splenectomy, the typical blood picture and relapses, with marked destruction, still persisted. The immediate operative mortality was 6.6 per cent. In other words, the end-results of splenectomy failed to show any permanent results from this procedure. However, in 8 of the 13 cases, a considerable temporary improvement was noted, lasting from two to six months. In general, the leukocytosis immediately after splenectomy and the level of the leukocytosis for some weeks afterward, contrasted with the average before operation, gave a rough indication of the future reaction in the red cell-forming part of the bone marrow. The patients with highest leukocytosis tended to show the greatest improvement after splenectomy. On the contrary, those who showed only a slight increase, eventually showed little improvement after this procedure. After splenectomy, the presence of a considerable number of very large blood platelets is striking. There is always a tendency to abnormally large blood platelets in pernicious anemia. Like the increase in the white count, the platelet increase seems to be of prognostic value. A persistently low platelet count in pernicious anemia indicates bone-marrow exhaustion. Lee, Minot, and Vincent have been impressed by the association of increase of platelets and thrombosis. Thrombosis is not an uncommon complication of splenectomy. It has been reported as a postoperative cause of death. Thrombosis or phlebitis have been noted in 3 of the cases of Lee, Minot and Vincent. In all 3, at the time of the phlebitis, there was a very large increase of platelets. At the time when the platelets increased, there were vague gastro-intestinal symptoms of varying severity. The association of this condition with thrombosis or phlebitis of some of the mesenteric veins is possible. Of course, this cannot be proved, but the authors point out that thrombosis in the usual course of pernicious anemia is extremely rare, whereas it is not uncommon after splenectomy for this condition.

The Howell-Jolly bodies constantly occur in red cells after splenectomy. In some instances 25 per cent. of the red cells contained them.

Blasts. After operation a shower of blasts, especially when persistent, seemed to be associated with ultimate improvement.

Reticulated Red Cells. The percentage of these should be taken as a measure of the bone marrow's activity. In order to do this, continuous observations should be made over considerable periods of time. These will form reliable indicators of bone-marrow activity and will be found as the forerunners of increased cell counts and of clinical improvement in the absence of excessive blood destruction.

The degree of response after splenectomy varies. The cases in which an increase of reticulated cells had been observed, either in the spon-

¹ Journal of American Medical Association, vol. lxvii, p. 719.

taneous course of the disease or after transfusion, usually showed greater increases after splenectomy. In 2 cases the increased reacting power of the bone marrow under the influence of transfusion seemed in some way to be related to the absence of the spleen.

Stimulation of the bone marrow frequently occurs spontaneously in pernicious anemia. One may find such stimulation usually associated with improvement after transfusion and after splenectomy. According to Lee, Minot and Vincent, splenectomy seems to constitute the greatest stimulation of the bone marrow of any known therapeutic procedure. Splenectomy, however, does not alter the essential course of the disease. Transfusion, while of less constant and less active effect, has two great advantages. It is relatively simple and can be repeated any number of times.

Krumbhaar,¹ of Philadelphia, likewise reported that the mortality in splenectomy for pernicious anemia was low, that splenectomy did not prevent the ultimate fatal outcome, that improvement followed splenectomy. Krumbhaar believed that the best results were obtained if the operation was preceded by one or more transfusions, and all patients who relapsed after operation might still be helped by transfusions. The most favorable results were to be expected in individuals who had not passed the fifth decade, in whom the disease had not existed for more than a year, and who had relatively good blood pictures. Individuals with enlarged spleens did better than those in whom the spleen was small or of normal size. The earlier the case in which splenectomy was done, the better the result. Far-gone cases should not be subjected to splenectomy, *i. e.*, those with spinal-cord symptoms or the presence of an aplastic exhausted bone marrow.

McClure, in speaking of pernicious anemia treated by splenectomy and repeated transfusion, said that about as much good can be accomplished by a single transfusion in pernicious anemia as is accomplished by a single inunction of mercury in the treatment of syphilis.

Among other cases McClure reported the *first instance of transmission of syphilis by transfusion in a case of pernicious anemia*. The donor was a close relative of the patient, and before giving blood denied having syphilis and also denied exposure to infection. Less than six weeks after transfusion, the patient returned with a pronounced syphilitic rash and mucous ulcers. At the same time a secondary eruption appeared in the donor. It then developed that the donor had an initial sore at the time he gave blood.

McClure² also reported an interesting case of benzol poisoning, causing symptoms of severe purpura hemorrhagica with a severe anemia of the aplastic type. Although several transfusions were performed in a number of other cases, so little improvement was noted that the procedure was not considered of value. However, in this case the result of each transfusion was so striking that the family of the patient saw the enormous immediate benefit and insisted that the treatment be continued. They produced donors, so that plenty of blood was available.

¹ Journal of American Medical Association, vol. lxvii, p. 723.

² *Ibid.*, p. 800.

The success in this case led to the belief that perhaps steady use of carefully planned transfusions persistently used to prevent the anemia and its results, might be of benefit in pernicious anemia. In addition to this, McClure advocated splenectomy. He believed that in earlier cases little benefit resulted from the fact that only a single transfusion was made. Repeated systematic transfusions had been carried out during the past year. The results were so encouraging that he felt that the life of a patient with pernicious anemia could be indefinitely prolonged if the spleen was removed as soon as the patient was in condition to stand the operation; sometimes it was necessary to transfuse several times before splenectomy.

If removal of the spleen did not effect a rapid improvement in the blood picture, McClure advocated transfusions until the hemoglobin was as high as 90 per cent., or more, never allowing it to fall below 75 per cent. As remissions often lasted several months or a year, many transfusions may not be required. It is well-known that anemia reduces the resistance of the body to infections. Thus by repeated transfusions the usual secondary causes of death in pernicious anemia can be avoided. "Who can tell but that within a few years of persistent transfusions the primary cause, whatever it may be, of pernicious anemia may lose its force and perhaps the disease be cured."

Smithies's reported 27 cases of pernicious anemia treated by multiple transfusions of blood and splenectomy. It was noted that infective foci were demonstrable in all the cases. He advocates multiple massive transfusions of whole blood, eradication of local foci of infection, and, lastly, splenectomy combined with removal of any abdominal focus of infection. Of the 27 cases treated, there were 2 operative deaths.

Vincent, of the Massachusetts General Hospital, employed 600 c.c. of blood at each transfusion, and believed that any relapse which does not show a tendency to spontaneous remission furnished an indication for transfusion.

Vincent called attention to a type of pernicious anemia which ran a steadily downward course without remission, which did not improve after transfusion, and in which little could be expected from splenectomy. The experience with his series of 15 cases agreed with that given by Krumbhaar. In short, splenectomy and transfusion are palliative.

Giffin reported 39 cases of splenectomy for pernicious anemia. In two instances the patient was in good condition one year after operation.

Giffin referred to the *examination of duodenal content for blood-derived pigment in patients with pernicious anemia*. In 33 cases of pernicious anemia, the work of Schneider¹ has been followed. High values of urobilin and urobilinogen in the duodenal contents had been found in all but 3 by the Wilbur and Addis spectroscopic test. In 19 other cases with various types of secondary anemia this same examination had been done and, compared with the high values in pernicious anemia, relatively low values had been obtained. In 3 out of 4 cases of hemolytic jaundice there were high values. Giffin said this test might prove

¹ Archives of International Medicine.

important in the study of patients with pernicious anemia; if there were high hemolytic values in the duodenal contents, and if, in spite of active hemolysis, there was a good blood picture, this should be a case favorable for splenectomy, since splenectomy is followed by a reduction of the hemolytic values. Giffin referred to cases of hemolytic jaundice in adults which showed a type of blood count characteristic of pernicious anemia as evidence of a possible relationship between the two conditions.

In speaking of splenectomy for splenic anemia, Thayer said the results did not seem to be uniformly beneficial especially in the cases with violent gastric hemorrhages. In hemorrhagic jaundice the results are uniformly beneficial.

Krumbhaar, in closing, said it is generally accepted that not only are blood transfusions valuable as a preliminary to splenectomy but that in themselves they are an efficient method of combating pernicious anemia. Indeed, it remained to be proved whether or not, equally good results could not be obtained by repeated transfusion in the absence of splenectomy, although the impression was prevalent that improvement after splenectomy was more lasting.

In all patients but 1, with pernicious anemia, operated upon at the Mayo Clinic, the spleen was found enlarged from twice to more than three times its normal size (360 to 910 grams as contrasted with 195, the average weight of the normal spleen according to Sappey).

W. J. Mayo¹ points out that the fallacy of accurately diagnosing the size of the spleen by means of percussion has been frequently demonstrated at subsequent laparotomies in his clinic. It cannot be said that the spleen is enlarged until it has grown to such a size that it can be felt beyond the free border of the costal margin.

Mayo gives an excellent review of our knowledge regarding the physiology and pathology of the spleen up to date.

The **technic of splenectomy**, as practised at the Mayo Clinic, has been reviewed in previous numbers. In a recent communication Balfour² recapitulates most of the points and brings out certain new ones.

In discussing the treatment of the pedicle after the spleen has been mobilized, he speaks of the variations in the location of the tail of the pancreas. In some instances the tail is short, lying against the renal surface of the spleen on the posterior aspect of the pedicle, where it may fit so closely into the hilus of the spleen that it acquires a concave edge. In other cases, the tail is attenuated and lies in front of the splenic vessels and in contact with the gastric surface, while in other cases, it often does not come into the operative field. Fig. 69 shows the spleen "turned turtle" and represents a frequent relation of the pancreas to the splenic pedicle. It is quite obvious that such a pedicle would not be ligated without including a portion of the pancreas. Fig. 70 shows that with the reflection of the lienophrenic ligament a better exposure of the tail of the pancreas is obtained so that it can be dissected free from its

¹ Journal of American Medical Association, vol. lxvi, p. 716.

² Surgery, Gynecology and Obstetrics, July, 1916, p. 1.

original position and allowed to drop away from the hilus of the spleen, thus freeing the splenic artery and vein preliminary to their ligation.

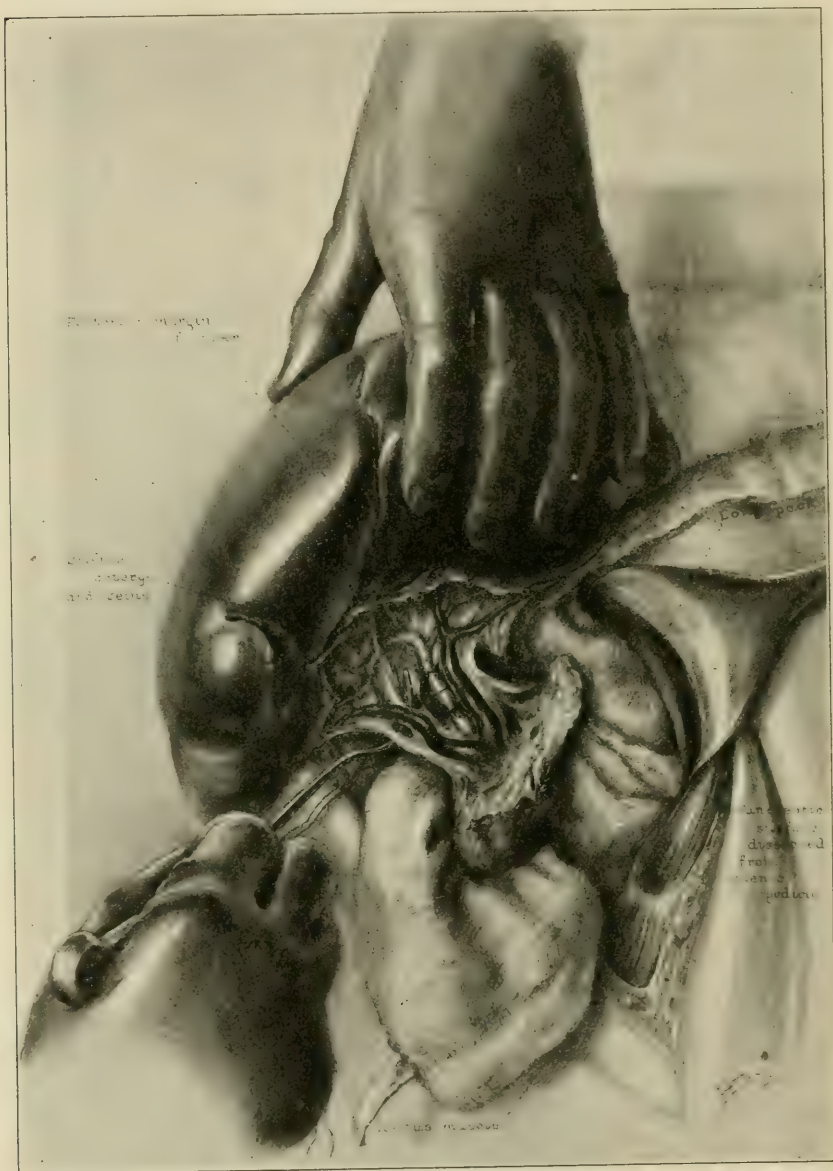


FIG. 69.—Posterior surface of spleen exposed, showing tail of pancreas which lies in the splenic pedicle, posterior to vessels. The pancreas should be dissected from its position before clamps or ligatures are applied. (Balfour.)

The dissection of the splenic pedicle is most advantageously carried out on its posterior aspect with the spleen displaced toward the midline.

As regards ligation of artery in order that the spleen can empty itself of blood through the veins, Balfour has done this in some cases, but has never been able to observe any difference in the convalescence or the effect of splenectomy on these patients as compared with those in whom the artery and veins were ligated simultaneously.

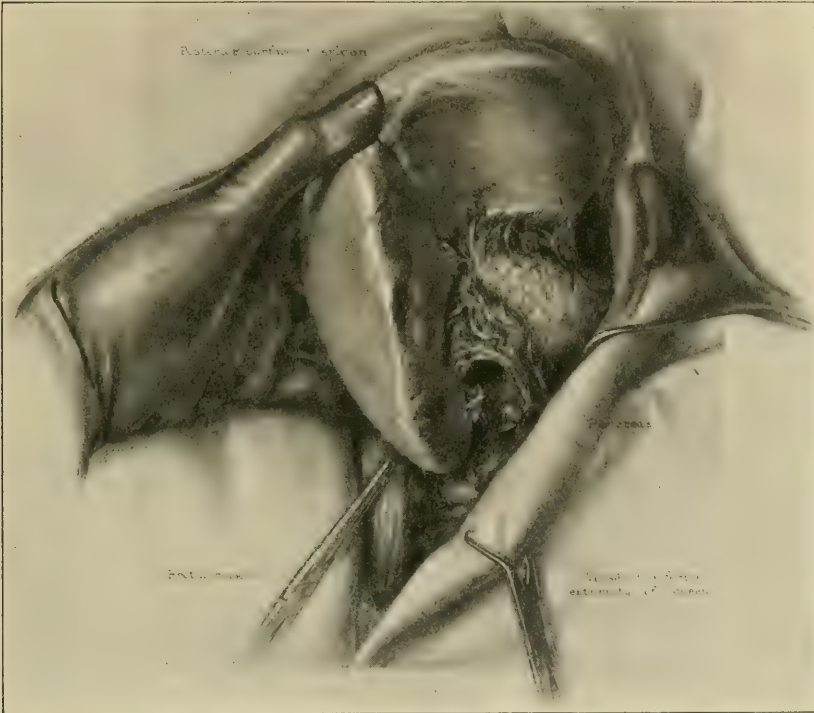


FIG. 70.—Ligation of splenic pedicle. (Balfour.)

ULCER OF THE STOMACH FOLLOWING SPLENECTOMY. Rovsing, quoted by Schou,¹ reports a gangrenous ulcer in the cardiac part of the stomach, found at autopsy, three months after splenectomy for Banti's disease, which had involved the vessels communicating with the spleen.

¹ Ugeskrift for Læger, Copenhagen, September 21, 1916, p. 1609.

GYNECOLOGY.

BY JOHN G. CLARK, M.D.

CANCER OF THE UTERUS.

The Cancer Problem. Although much of the world's European literature was cut off at its source last year, there was still a considerable product from the Teutonic kingdoms and a fair showing from France and England. This year we have almost nothing of value to record from any of these countries. The medical literature of the allied countries is almost entirely of a military nature, and nothing has come out of Austria or Germany. This year our material has been gathered almost exclusively from American periodicals. We regret that as yet we have not assumed in this country as advanced a position in medical research as we trust may be our distinction in coming years. The possibilities are unique and the opportunity for American advance in all departments of medicine is singularly inviting. In the mere manual technical departments of medicine we have no cause for apology, but we regret the paucity of noteworthy laboratory and research papers. Because of the ever-increasing standard of requirements for entrance to our medical schools and of the better preparation of our students for the practice of medicine, the standard of professional efficiency must increase; but as yet a widespread research activity is not very evident. Already in America there are a number of departmental foundations devoted to the cancer problem, but, as for anything of epoch-making value, we have nothing to record. The question of etiology still stands *in statu quo*. Notwithstanding the continuous demand upon the resources of American philanthropists, the work of the Society for the Prevention of Cancer has been pushed with commendable vigor, and we believe the ultimate result will be of great value in stamping out the disease through surgical means in its earliest stages. As yet this educational movement has not been under sufficient headway to make any decided effect upon our statistics of cures, but we feel assured that within an appreciable time it must have a general beneficial influence, for already American women are taking earlier cognizance of the danger signs of cancer and are much more prompt in seeking medical advice. The public press, as well as the various state and national medical journals, have given their share of space to this important subject, and a new journal of the highest standards, both ethically and editorially, devoted exclusively to the subject of cancer, has made its appearance. We refer to the *Journal of Cancer Research*, the official organ of the American Association for Cancer Research, which appears quarterly, and which should receive the hearty support of the entire profession.

HOFFMAN'S STATISTICAL WORK. It is gratifying to note the interest which has been displayed in this subject by the larger life insurance companies. Several excellent statistical studies have been contributed from these sources, the most exhaustive and comprehensive of these being the stupenduous work of Mr. Frederic L. Hoffman, chief statistician of the Prudential Insurance Company of America. His work, which has been published in book-form for gratuitous distribution, is dedicated to the American Society for the Control of Cancer and the American Association for Cancer Research, and is entitled *The Mortality from Cancer Throughout the World*. The book comprises over 800 pages, 200 of which are devoted to valuable discussions of the results attained and the deductions drawn from the study, while the remainder of the book contains hundreds upon hundreds of carefully executed tables and charts elucidating the subject of cancer from every stand-point. The book is well worth the careful perusal of any person interested in cancer, and its educational value is so great that we shall review it somewhat at length.

The general conclusions reached by the author are that much, if not most, of the available statistical information regarding cancer mortality is tentative, and trustworthy only in an approximate sense. Extreme caution is always necessary in the use of statistical data; but in the main it is held that the information can be relied upon to justify broad conclusions. The aggregate results of the investigation show that cancer is much more common than has generally been assumed; that the mortality from the disease throughout the civilized world exceeds 500,000 per annum, and in the United States about 80,000 at the present time; that the disease is increasing in practically all civilized countries, and, as a general rule, in all its principal forms or varieties, and that it is therefore strictly within the limits of scientific conjecture that a further rise in the death-rate may be anticipated unless the disease is made subject to more effective methods of treatment and control. It is maintained that this increase is not apparent but real; in other words, not the result of improved diagnosis or more scientific classification or of a changed age distribution. Combining the returns for the United Kingdom, Norway, Holland, Prussia, Baden, Switzerland, Austria, the cities of Denmark, the Commonwealth of Australia, and the Dominion of New Zealand, it appears that these countries in 1881, had an aggregate population of 98,380,000 and 44,047 deaths from cancer, equivalent to a rate of 44.8 per 100,000 of population; by 1891, the rate had increased to 59.6, by 1901 to 76.3, and by 1911 to 90.4. Thus, during thirty years, the cancer death-rate in these countries, which are typical of the civilized world, has more than doubled; or to be exact, the rate for 1911 was 101.8 per cent. in excess of the rate prevailing in 1881.

Another illustration is the experience of the State of Massachusetts. In 1871, the recorded cancer death-rate was 36.9 per 100,000 of population; by 1881, the rate had increased to 52.3; by 1891, to 60.9; by 1901, to 73.1; and by 1911, to 92.6. Boston has for many years been one of the medical centers not only of the United States, but of the world. There

are no reasons for believing that medical diagnosis was so crude or imperfectly developed in 1871 that one out of every two deaths from cancer should have been erroneously diagnosed or wrongfully classified under some other disease. Nor is there any evidence to substantiate the point of view that the age distribution of Massachusetts has undergone such profound changes as to account for the higher frequency of cancer at the present time. In 1880, the proportion of population ages of sixty-five and over in Massachusetts was 5.4 per cent.; in 1900, it was 5.1 per cent.; in 1910, it was 5.2 per cent. From a practical point of view in statistical analysis, these changes in the age distribution can have been of only slight effect on the cancer death-rate.

Confining our attention to the Western Hemisphere, we find that the mortality of New York, Boston, Philadelphia, and New Orleans has shown a steady decline in practically all infectious and contagious diseases in the last fifty years. Cancer, however, is increasing, and has increased from 46.4 to 72.1 per 100,000 of population in these four cities. In the registration area of the United States during the decade ending 1912, the death-rate from cancer was 72.8 per 100,000 of population, or 55.7 for males and 90.6 for females. Regarding the *influence of age and sex*, we find that the death-rate is practically the same for both sexes at ages under five years, a trifle higher for males at ages from five to fourteen, but at ages from fifteen to forty-four the male rate is 13.6 per 100,000 and the female rate is 32.1, or 136 per cent. in excess of the male rate. At ages of forty-five and over, the male rate is 236.5 against 366.4 for females, or, in other words, the female rate is 54.9 per cent. in excess of the male. The excess in the female cancer mortality-rate is to be found chiefly in the deaths from cancer of the generative organs and breast, accounting for 39.3 per cent. of the total mortality from cancer among women. Eliminating cancer of the generative organs and breast, it is shown that the cancer death-rate for males was 55.7 per 100,000 against 55.0 for females. The *effect of race* on the cancer problem, as shown by all available statistics for the United States and other countries, is that cancer is relatively rare among primitive races. Thus, during the period of 1906 to 1912, in thirty large southern cities of the United States, the cancer mortality-rate of the white population was 80.3 per 100,000 and of the colored 55.2. The available evidence is rather to the effect that cancer is chiefly a disease of the well-to-do, and, by inference, a disease of civilization. Regarding the *marital condition*, it has been ascertained that cancer of the breast and ovaries is more common in single than in married women, but cancer of the uterus is decidedly more common in married women. The *effect of climate* on the incidence of cancer was studied, and the conclusion would seem to be justified that there is a decreasing rate of cancer frequency with diminishing distance from the equator. How far this result is attributable to race and primitive conditions of life, rather than to climatological conditions, cannot be stated at the present time.

While, of course, space does not permit a careful review of the numerous charts contained in this book, we wish to call attention to a few of the most interesting ones from the gynecological view-point. Thus,

the mortality from cancer, by organs and parts, according to sex, in the United States registration area, 1908-1912, is tabulated:

Organ or part.	Rate per 100,000 population.		
	Total.	Males.	Females.
Buccal cavity	2.8	4.6	1.0
Stomach and liver	29.6	28.8	30.5
Peritoneum, intestines and rectum	9.5	7.7	11.3
Female generative organs	11.4	..	23.4
Female breast	7.0	..	14.3
Skin	2.8	3.5	2.1
Other or not specified organs	11.6	13.2	10.0
All organs and parts	74.7	57.7	92.6

To one not accustomed to mortality statistics, the above table may not have much significance so that the following table of the *estimated* total mortality from cancer, by organs and parts in the continental United States, 1913, is inserted since it gives actual figures and percentages and will be better understood and more impressive to the practitioner.

Organ or part.	Rate per 100,000 population.	Number of deaths.	Percentage distribution.
Buccal cavity	3.11	3,007	3.94
Stomach and liver	31.23	30,215	39.59
Peritoneum, intestines and rectum	10.47	10,128	13.27
Female generative organs	12.17	11,776	15.43
Breast	7.25	7,021	9.20
Skin	2.73	2,633	3.45
Other or not specified organs	11.92	11,539	15.12
All organs and parts	78.88	76,319	100.00

Figs. 71 and 72 graphically show the cancer mortality from 1908 to 1912 in the various countries and cities of the world:

While the United States registration area is only twelfth on the list of the countries of the world in regard to total cancer mortality statistics, we find that it takes a much more prominent and serious position when we consider only cancer of the female generative organs. This is shown in the following table representing the rate per 100,000 of female population for the period 1906-1910:

England and Wales	24.2
United States (registration area)	22.1
Bayaria	21.6
Switzerland	21.4
Japan (1909-10)	20.9
Scotland	20.6
Cuba (1908-12)	18.9
Italy	16.0
Australian Commonwealth (1908-12)	15.5
Holland	13.2
Ireland	12.8
Uruguay	12.2
Norway	11.5

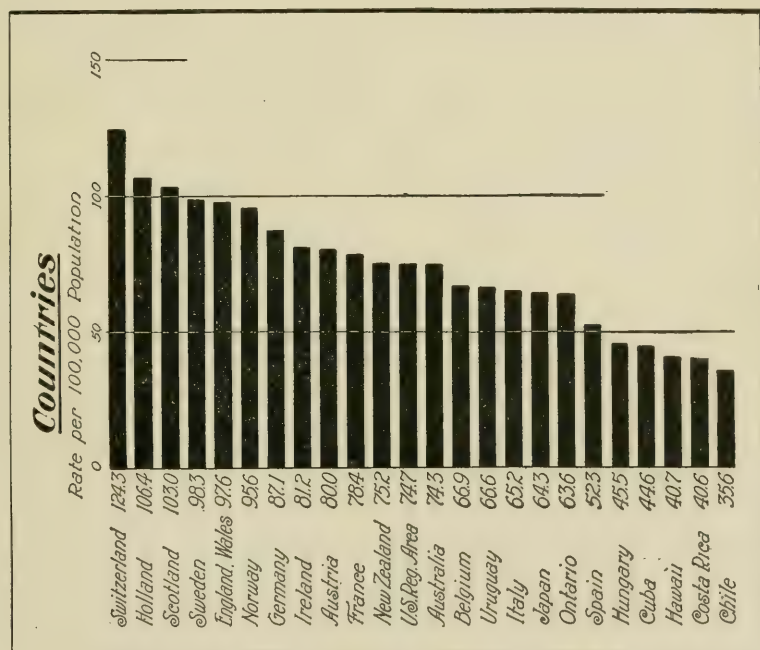


FIG. 71

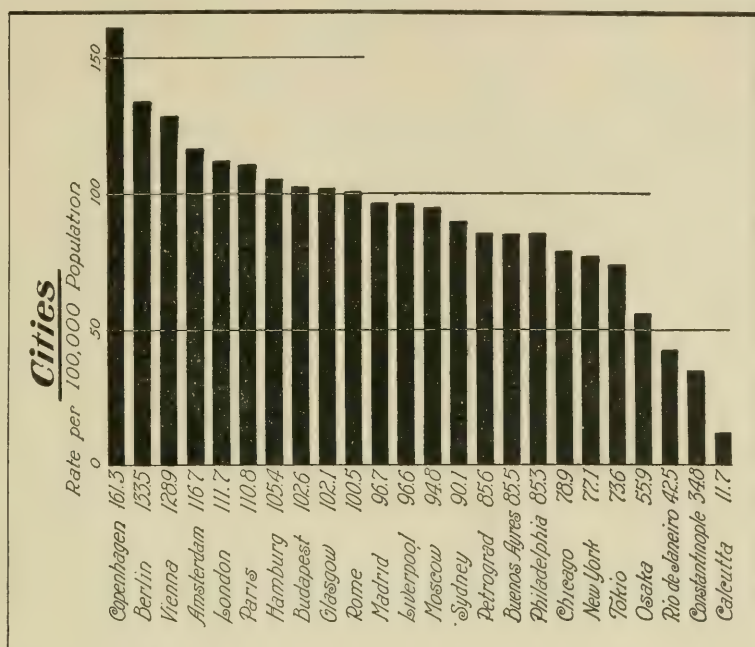


FIG. 72

The same enthusiasm which has carried Hoffman, and others, along in their work in this country is being displayed in foreign lands, especially among the non-belligerent nations. It is interesting to note in this connection that the Norwegian Cancer Research Association pays a crown (27 cents) for each report of a case of cancer in Norway sent in to the secretary. The association also examines and reports on specimens of tissue suspected of being cancerous, from the living subject or the cadaver, with no expense to physician or patient.

Etiology of Cancer. THE IRRITATION THEORY of cancer continues to remain the favorite among the various hypotheses that have been propounded. The theory, as Rockey¹ conceives it, is that cancer is caused by a defensive process of the tissue cells to a great variety of irritations, and that there is no specific external cause for cancer. To repair a defect caused by a destructive irritant, the tissues produce new cells with all possible rapidity. The defensive reaction to any irritation that falls short of destruction of the cells is an active karyokinesis. The more active this becomes, the more nearly the cells approach the embryonal type. The more the normal process of healing is interfered with by a continuance or recurrence of irritation, the more irregular is the mitosis of the cells. This irregularity is a result of the struggle for existence, in which they fail to produce perfect cells. This is true both of the epithelial and connective-tissue cells. Under ordinary conditions, the granulation tissue forms a bed, across which the new epithelial cells are projected, and the defect is closed without any disarrangement of their relative position. At the surface where they belong, they attain a satisfactory degree of normal structure and formation. When such healing is continuously interfered with by oft-repeated irritation, and that irritation short of destruction is closely balanced with the reparative power of the tissues, then the reproductive power of the cells is enormously increased. In their effort to reach the surface where they belong, the young cells, with their newborn karyokinetic energy, and with the tolerance for the mesoblastic tissues which they have acquired by contact in the embryonal form in their defense reaction to the original irritation, continue to grow and disseminate without guidance. The young cells infiltrate the tissues in all directions. It is only when long-continued or repeated irritation destroys the basement membrane and unduly stimulates a defensive karyokinesis, that the adjacent mesoblastic and epiblastic cells lose their antagonism for each other and mingle, that the invasion of the mesoblastic tissues by immature epiblastic cells takes place, and a cancer is formed.

ENZYME THEORY OF CANCER. Bristol,² as a result of theoretical study and preliminary experiments on white rats, concludes that cancer is the result of localized unchecked overcombustion or hyperoxidation in epithelial cells. Furthermore, he believes that this condition is brought about by the concentrated, accelerated, and uninhibited action of intracellular oxidizing enzymes or their coenzymes as a result of various injurious agents. Concerning the ultimate problems in tumors,

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 171.

² Medical Record, 1916, vol. lxxxix, p. 180.

however, he states, "It is evident that here, as elsewhere in pathology, we are dealing not with independent problems, but with specific outlooks only on the wider field of general biology."

Relation of Arteriosclerosis to Epithelial Malignancy. A few years ago Theilhaber¹ made the statement that when organs which have been invaded by cancer are examined, one usually finds, in the connective tissue about the growth, very few cells, bloodvessels which are stenosed and thickened, and signs of endarteritis obliterans. In order to substantiate or contradict this statement, Warner² made a study of 206 cases of carcinoma of all organs and regions. He did not find the various old-age conditions of endarteritis, acellular connective tissue, or fibrosis present in all of the cases examined. In the study of the various abnormal conditions present in the control series of non-malignant uteri, sclerosed vessels were found without carcinoma, while, on the other hand, many uteri with normal vessels, showed the presence of cancer-cell infiltration. Inasmuch as so many of the non-cancerous uteri showed the so-called old-age conditions, one would expect to find cancer in them more frequently if they are a positive factor in the development of cancer. The same may be said of the ovary, where it is quite common to find sclerotic changes in the vessels and fibrosis in the stroma without the patient having developed cancer. Of the 206 cases of carcinoma examined, 105 showed arterial obstructive changes. This gives us substantially an equal division between endarteritis and normal vessels. Fibrotic changes were present in 118 cases (57 per cent.), lymphocytic infiltration was present in 85 cases. In a word, therefore, this study apparently disproves any positive relationship between arteriosclerosis or vascular fibrosis and malignancy.

Precancerous Changes in the Uterus. Clinicians are generally agreed that there are no pathognomonic symptoms of uterine cancer until the tumor-growth has become well established, and usually not until its destructive capacity is grossly manifested. Atypical bleeding or discharge, combined with other symptoms and a careful physical examination, can only create a weak or strong suspicion of its early existence without the aid of a competent histological examination, from which it is universally expected that a positive confirmation or denial of the clinical suspicions will be made. Failure to receive a positive diagnosis often creates in the mind of the clinician a suspicion of the incompetency of the pathologist, or in the mind of the pathologist that he has not been furnished with the proper material. Each of these conditions may maintain, but an analysis of the histological criteria upon which a positive diagnosis of a fully established cancerous growth is made shows that the pathologist, like the clinician, is ordinarily not prepared to make such a diagnosis until some amount of destructive capacity is histologically manifested. In other words, cancer is an evolutionary process, requiring time to show its actively destructive purpose. Arguing along these lines, Stone³ presents over a dozen cases of what he believes to be precancerous conditions, and which should be recognized as such by the

¹ Surgery, Gynecology and Obstetrics, 1914, vol. xix, p. 650.

² Ibid., 1916, vol. xxiii, p. 413.

³ Ibid., 1916, vol. xxiii, p. 248.

pathologist. He calls attention to the fact that we find, in the study of uterine pathology, numerous morphological alterations of epithelial growth which differ but little from the regenerative activity of benign lesions, but which, after a longer or shorter time, show features that are differentiated with difficulty from the alterations we know typify malignant neoplasm. The strongest support of this assumption is derived from the reproduction of types which are seen in the different stages of their progress. We find the atypical features of a healing erosion, for example, determined by the original type of the primary erosion-simple, papillary, follicular; and we find the atypical types again reproduced in the different types of fully established uterine cancer. In Stone's cases there are atypical healing erosions which are prototypes of either an epidermoid cancer or a papillary adeno-carcinoma. There are leukoplakias which are prototypes of adult acanthomata. There are glandular hyperplasias which lead to adenoma or adenocarcinoma. Finally, there are focal areas of leukoplakia, combined with adenomatous hyperplasia, which may well furnish an origin for tumors designated as adeno-acanthomata. In short, for each type of fully developed carcinoma there is a corresponding type of benign and intermediary change. Clinical observation increasingly confirms the sequence of definite benign lesions in the uterus and cancer, but its evidence is thus far too scanty either to confirm or deny their histogenetic relations. In order to work out this problem, a closer coöperation is required between the clinician and the pathologist, with the idea constantly in mind that the morphological features of intermediary stages may exist. Stone believes that it is no argument against such an assumption, because no tumor process presents or follows in a given case. The evidence is already sufficient to show that a fully established cancer may exist for a certain time without giving evidence of its presence, and numerous cases are recorded in which the curette has completely removed the disease.

Experimental Therapy of Malignant Neoplasms. In order to determine the effect of *normal blood serum* from healthy animals on carcinoma, Fraenkel and Fuerer¹ took mice which had been inoculated with transplantable carcinoma or sarcoma. After the tumors had assumed definite growth, the animals received intravenous injections of blood serum from various other laboratory animals such as the horse, sheep, goose, dog, etc. In all the tests, careful controls were made, with the result that after comparing the results of the experiments it was found that normal serum has practically no effect on the tumor growth. The authors next turned their attention to chemotherapy and experimented with *cholin*, which had been exploited as a cancer cure under the name of "Cancroin." Here again, they failed to note any beneficial effect of the drug on the transplanted tumors. They remark that the tendency toward a spontaneous cure is the most disturbing element in estimating the effect of different drugs on experimental cancer. Following their work with cholin, they continued with chemotherapeutic experiments using many other chemical substances, among which were arsenic preparations, quinine and its derivatives, iodine salts, telluric acid, salts of boric and

¹ Wien. klin. Wchnschr., 1916, vol. xxix, pp. 63, 96, 198.

hydrofluoric acids, nitroglycerin, erythroltetranitrate, picric acid, and hexamethylenamine, but the results of all these experiments constantly failed to show any beneficial effect upon the tumors.

CHEMOTHERAPY continues to interest Weil,¹ whose work along this line we quoted last year. Although he² has nothing very encouraging to report, some of his more recent experiments are interesting. He concludes that living tumor cells are not penetrated by colloidal dyes. The necrotic areas of tumors, however, present an intense discoloration after the intravenous or subcutaneous administration of dyes of the diazo group, and this discoloration is very frequently associated with some discoloration of the liver, while the other tissues of the body remain macroscopically unstained. The staining of the necrotic areas of the tumors, according to Weil, is not due solely to the death of the cells, inasmuch as areas of pulmonary caseation in the same rats do not present any discoloration; nor is it a simple physical phenomenon, subject to the laws of diffusion of fluids into non-living colloidal material. The diffusibility of dyes through membranes, the electrical charge, the chemical reaction and the composition of the colloids influence the result. In the course of this work, a series of new synthetic compounds analogous to congo red were injected into tumor-bearing rats, but no definite therapeutic effect could be determined.

EFFECT OF PHLORIDZIN ON TUMORS IN ANIMALS. Benedict and Lewis,³ reported the cure of malignant tumors in rats by the induction of diabetes by means of phloridzin. In an effort to duplicate these results, Wood and McLean⁴ undertook similar experiments. They were doomed to disappointment, however, inasmuch as they did not observe absorption of the tumors in any of the cases treated; in fact, in the majority of the experiments, the growth among the treated animals was much more vigorous than that among the controls. These observers firmly believe that any cures obtained in working with the buffalo rat sarcoma must be ascribed to spontaneous absorption rather than to the effect of the therapeutic agent.

INFLUENCE OF THE ANTERIOR LOBE OF THE PITUITARY BODY UPON CANCER. Last year⁵ we cited the interesting work of Robertson and Burnett in determining the influence of emulsions of the anterior lobe of the pituitary body of the ox upon the growth of carcinoma. A subsequent report from these authors⁶ states that one of them has succeeded in isolating the growth-controlling substance from the pituitary gland, and has given it the name "*tethelin*." In experimental work with this substance, he found that hypodermic administrations of it increased markedly the rate of growth of the primary tumor and the tendency to form metastases in rats inoculated with carcinoma, in this, as in other respects, reproducing the action of the whole of the anterior lobe of the pituitary body. Other alcohol-soluble extractives of the anterior lobe,

¹ PROGRESSIVE MEDICINE, June, 1916, p. 220.

² Journal of Cancer Research, 1916, vol. i, p. 95.

³ Proceedings of Society of Experimental Biology and Medicine, 1914, vol. xi, p. 134.

⁴ Journal of Cancer Research, 1916, vol. i, p. 49.

⁵ PROGRESSIVE MEDICINE, June, 1916, p. 205.

⁶ Journal of Experimental Medicine, 1916, vol. xxiii, p. 631.

with the exception of the lecithin fraction, exert no appreciable effect upon the growth of carcinoma in rats. The lecithin fraction, as in previously reported experiments in which lecithin obtained from eggs was employed, causes evident retardation of the growth of carcinoma in rats.

INFLUENCE OF CORPUS LUTEUM ON CANCER. As a result of experimental work upon rats, Lathrop and Loeb¹ ascertained that castration of female mice below the age of six months leads to a very marked decrease in the cancer incidence of these animals, although they have not so far succeeded in preventing cancer under these conditions. Castration in mice above the age of six months has had no effect on the cancer incidence. The prevention of breeding in female mice decreases the cancer incidence and increases the cancer age, though to a much smaller degree than does castration. Non-breeding female mice reach a higher age than breeders. These results are interpreted as due to the influence of the corpus luteum on the growth of the mammary gland (the site of the cancer) and they are the first experimental demonstrations of internal secretions as an etiological factor in the spontaneous development of cancer. In interpreting how extirpation of the ovaries influences the development of carcinoma in mice, we have to consider the relation of the ovaries to the mammary gland. It seems an established fact that a substance given off by the corpus luteum induces the periodic growth of the mammary gland during pregnancy, and in some species also during periods of the sexual cycle unaccompanied by pregnancy. It is therefore most probable that castration is effective because it eliminates the corpora lutea with the resulting elimination of the periodic growth of the mammary gland, allowing it to remain in an uninterrupted state of rest. On the other hand, it appears that after the mammary gland has been for a longer period of life under the influence of the corpus luteum, the threshold of growth processes which allows transition into a carcinomatous condition has been reached, hence extirpation at later periods of life is found to be without effect. It seems probable that any factor which periodically, over long periods of time, induces increments in growth energy, may be a factor in the development of carcinoma.

Cancer in an Infant. We have previously called attention² to the liability of most of us to forget that cancer is by no means an impossibility in the young, although, of course, it occurs with greatest frequency in those past middle life. In this connection it will be interesting to report in brief a case of *glandular carcinoma of the uterus* in a child, two and one-half years old that has been recorded by Adams.³ The history states that for three weeks before admission to the hospital the child had a bloody flow from the vagina which had increased in amount and frequency. There was no pain, but a fulness had been noted in the child's abdomen. There was no family history of carcinoma. On examination, a palpable tumor, partly cystic in consistence, was revealed in the hypogastrium, situated between the bladder and rectum. At operation, the rectovesical space was found to be occupied by a cystic growth about

¹ Journal of Cancer Research, 1916, vol. i, p. 1.

² PROGRESSIVE MEDICINE, June, 1916, p. 206.

³ British Journal of Children's Diseases, 1916, vol. xiii, p. 266.

the size of half a tennis ball, obscuring the position of the uterus, but was obviously attached to the roof of the vagina. It was too adherent for complete removal, and the child died two months later. At autopsy, a large growth, completely covered by peritoneum, adherent to the posterior surface of the bladder and closely connected with the rectum posteriorly, was found. The pathological report showed that the specimen consisted of the uterus and its appendages, both the corpus and cervix of the uterus being largely replaced by broken-down tissue. The microscopic diagnosis was carcinoma arising from the glandular epithelium of the corpus, showing both columnar and cuboidal cells, having a somewhat tubular arrangement. Such cases as this, it must be admitted are exceedingly rare, but, whenever they occur, they serve to remind us that the cancer tree begins to sprout almost at its roots and we should be on the lookout for this insidious disease at all ages.

Prophylaxis. Until we know the actual cause of cancer, it will be impossible to intelligently consider the subject of preventive measures with a feeling of absolute confidence. The tendency at present, however, as has been stated in the foregoing pages, is to eradicate the precancerous lesions, but the difficulty lies in the fact that the conception of a precancerous lesion varies in the minds of different surgeons. Perhaps we should adopt the view-point of Watkins,¹ who believes that hemorrhage occurring after the menopause has been established for some time should, as a rule, indicate hysterectomy and the case should be considered cancer. If cancer is not found, the operation is justified as a prophylactic measure. Cancer is the *common disease* that produces bleeding from a uterus that has become senile and atrophic. Watkins believes that fewer mistakes in diagnosis are made by considering all of this group cancer than by the use of other known means for diagnosis in individual cases and he has worked along these lines for some years with highly satisfactory results. The dangers of malignant degeneration in fibroid tumors of the uterus have been found by statistics to be between 3 and 5 per cent. The dangers incident to operative treatment have been reduced so that they can conservatively be placed at 1 per cent., so that the dangers from malignant disease in fibroids are three times more than from operation. While Watkins undoubtedly has the best interests of his patients at heart in advocating such treatment, personally I cannot fully agree with him since, in a certain percentage of cases, cancer can be excluded, and in such cases a single application of radium will, as a rule, cause the hemorrhage to cease. This will be considered further under the subject of radiotherapy, as observed in my own clinic.

Radiotherapy. Last year² we referred to the extensive review of the literature on radiotherapy by Schmitz.³ He has continued his investigations and presented his findings in his inaugural thesis before the Chicago Gynecological Society in June of last year. In order to determine the dosage of radium necessary in an individual case, he carried out some experiments in the human body in cases of recurrent cancer of

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 442.

² PROGRESSIVE MEDICINE, June, 1916, p. 206.

³ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 191.

the breast, characterized by the formation of multiple nodules. A nodule was removed under local anesthesia and subjected to a microscopic examination to determine the pathological nature. Then the gamma rays of 50 mg. of radium element were applied for four hours to another nodule, for six hours to a second one, for eight hours to a third one, for ten hours to a fourth one, and so on. After ten days the nodules were removed and subjected to a microscopic examination. Particular care was exercised in noting the distance of the nodule from the skin surface. These experiments demonstrated repeatedly that the gamma rays of 50 mg. of radium element destroyed carcinoma tissue within a distance of 1 cm. after an application of twelve hours, *i. e.*, 600 mg. hours. The method of screening the radium in order to allow only the gamma rays to reach the tissues is very simple. The alpha rays are arrested by the glass capsule in which the radium salt is contained; the beta rays are absorbed by a capsule of brass, silver or lead, preferably brass as it is cheaper and cleaner than the other metals; the secondary rays formed in the metal screens are arrested by a para rubber tube of 2 mm. thickness. The screens are so built that the radium capsules may be arranged either tandem or in twin formation.

Of the 80 cases of pelvic cancer treated, 62 were uterine, 10 rectal, and 8 vesical, and the results show that the prognosis is best in vesical, almost equally favorable in uterine and vaginal and not so favorable, even poor, in rectal carcinoma. Eleven clinical cures were obtained in 35 inoperable uterine, none in 6 inoperable rectal, and 3 in 4 inoperable vesical cancers. The term clinical cure implies a complete subjective and objective cure of the cancer as far as it can be determined by an exact palpation and a microscopic examination. Fourteen clinical cures were obtained in 45 inoperable pelvic cancers, *i. e.*, 31.1 per cent. This percentage would have been much more favorable if hopeless cases had not been included, since not a single case was refused treatment, in fact, 7 of these cases were in a far-advanced and terminal stage. Of the 19 recurrent carcinomata treated, 15 were uterine, 3 were vesical, and 1 was rectal. Four of the uterine cancers are clinically well; 1 vesical cancer was in a terminal stage when referred for treatment, 1 was clinically cured, and 1 has remained refractory to treatment; the rectal cancer was in an advanced stage when treatment was begun, and it has remained refractory. Summarizing these cases, we find that 5 of the 19 recurrent cases (25.8 per cent.), are clinically cured, or, if we subtract the 5 advanced and hopeless cases, the percentage of clinical cures would be 35.7. The prognosis of radium treatment in recurrent cancers is not as good as in the inoperable cancers.

Miller¹ has applied radium in 26 cases of inoperable cancer of the cervix and recurrent cancer following hysterectomy, and he believes that there is not the slightest doubt that radium exerts a powerful influence over cancer cells. This influence is not the result of cauterization, as many pathologists would have us believe, nor is it because of any selective action on cancer cells, but rather its effect on all cell life.

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 437.

Miller agrees with Burnam in the belief that it can be assumed that radiation deleteriously affects all living tissue, but under this influence the normal tissues are preserved because the fluids and the protective agencies of the body are all constructed to help the normal tissues, and that the pathological tissues disappear because, weakened by radiation, they are unable to withstand the normal protective mechanisms of the body. Miller still believes, as he always has, that surgery is the only treatment so far known that offers a permanent cure for cancer in the early stage of the disease. However, as his experience with the radical operation increased, the percentage of cases in which he advised it gradually decreased, and at present he no longer recommends it in the so-called borderline cases, believing that such formidable treatment, with its primary fatalities and subsequent morbidity, does not give sufficient returns for the risk incurred. It was with the idea of increasing the permanent results obtained by surgery by the combination with radium, the conversion of inoperable into operable cases, and last, but not least, the amelioration of the suffering of the hopeless cases, that he determined to try radium. Of his series, 15 inoperable cases were treated solely with radium. They were far advanced, showed the usual cachexia, and several were not good risks even for simple cauterization under anesthesia. Of these cases, 4 have died and 2 are slowly succumbing to the disease, 5 are apparently clinically cured. His experience leads him to believe that cauterization preliminary to radium treatment is not the best mode of procedure, since he is positive that it required a longer time to check the local symptoms, and the subsequent histories do not show that they remained well any longer for having had the preliminary cauterization. Moreover, this procedure requires anesthesia and it is attended by no little discomfort and certainly retards the primary effects of radiation. The method of application that has been employed has been the intermittent method, using from 75 to 85 mgs. of radium element and giving from 3000 to 5000 mg. hours within a week or ten days. One month later further applications are given if indicated.

A Report from Scotland. Turner,¹ in reporting the experiences with radium at the Royal Infirmary in Edinburgh, states that while carcinoma of the vagina or cervix appear to be vulnerable to radium, and, if localized, can in many cases be entirely removed, recurrence after a varying interval is the rule. Life is in the meantime prolonged, however, and the patient may be greatly benefited by the relief from pain, the cessation of discharges, and by the gain of health, strength and weight. In the application of radium, a preliminary curetting is often of service by removing part of the growth and permitting the radium salt to be applied more effectively to the root of the disease. Dosages in excess of 3000 mg. hours are employed, and the radium is not screened except by such coverings as are necessary to preserve it from injury or to protect the sound tissues.

Röntgen Therapy. There have been a number of new developments in röntgenology, both in the production of more powerful apparatus and

¹ Edinburgh Medical Journal, 1916, vol. xvi, p. 204.

in the refinement of therapeutic methods, making possible more accurate estimation of the dosage. Nearly three years ago Coolidge announced the invention of a new *x*-ray tube which has proved to be a powerful and very precise instrument. New and powerful sources of high tension current have been devised. The technic of irradiation has been much improved by the adoption of cross-fire methods and the practice of filtration. It is no longer considered necessary to place the *x*-ray tube at a great distance from the skin, for inasmuch as the intensity of the *x*-rays varies inversely as the square of the distance of the anode from the part under fire, it is evident that when a tube is brought nearer to the skin, the time required for a certain dosage to a deep-lying structure will be proportionately diminished. The former objection to the short focus skin distance was the much greater danger of injury to the skin. Since the introduction of filtration methods, however, this danger of skin injury is eliminated to a considerable degree, and it is now possible to bring the tube much closer to the skin, thus materially shortening the time required to administer an effective dose. These various developments have rendered possible the practical employment of effective doses of Röntgen rays aggregating at least one hundred times the maximum dose considered safe ten years ago. After reviewing the advances in röntgenology and röntgenotherapy in this manner, Case,¹ who has had an enormous experience with these methods, states that one of the first effects of the Röntgen rays in the treatment of cancer of the uterus is the disappearance of pain, even severe pain, although sometimes not until after a prodromal exacerbation. Even in the most unfavorable cases where the effect on the size of the tumor is only slight, quick and permanent relief from pain is often secured. There is usually a preliminary temporary inflammatory swelling and increased secretion from the tumor, but soon the bleeding and the putrid secretion stops and there is only an odorless serous discharge which disappears in a few weeks. With the favorable cases, there is seen, in the course of a few months, a contraction of the growth, ulceration heals over and the cervix regains its normal form; finally, senile atrophy of the genitalia supervenes. Decrease in the size of the tumor is often only superficial and unsatisfactory, but the general condition is usually improved, as evidenced by a gain in weight and diminution of the cachexia and anemia. The degree to which untoward effects are experienced differs greatly according to the patient and the size of the doses. There may be weariness, even to prostration, fever, nausea and perhaps vomiting. Some of these effects are due to the rays themselves and to the changes brought about in the air in the room by the high-tension currents. Others are due to acidosis brought about by the absorption of the products of cell destruction. Bladder irritation is occasionally a distressing complication, but Case has seen rectal tenesmus in only a few cases, although after radium treatment, this is a fairly common complaint. He makes a very definite statement to the effect that in no case considered operable has operation been postponed for Röntgen or radium

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 429.

treatment, and, further, while he has temporarily arrested the disease in many cases, he has yet to see the first case of definitely demonstrated permanent *cure* of deep-seated pelvic cancer following the application of röntgenotherapy. Such clear-cut, truthful and unbiased statements coming from an experienced röntgenologist of repute may be taken as the summary of the present status of röntgenotherapy in uterine cancer.

Other non-operative Methods of Treating Cancer. THE PERCY TREATMENT. During the past year there have been occasional references to this treatment in medical literature, but very little has been written by Percy himself that can be considered in the light of a new communication. All that we have been able to find emanating from Percy's clinic has been a repetition of his original articles, laying special emphasis here and there on technical points in the operation. The medical profession has been quietly waiting for a detailed report of cases and statistical information from the originator of this method, but, at the time of this writing, no such reports have been forthcoming. It is evident that much of the enthusiasm which greeted the advent of this treatment a few years ago has subsided, although perhaps this may be only a temporary apathy. The reason for Percy's failure to report figures is difficult to conjecture, although he¹ has made a statement that is not without interest to the effect that when he publishes the statistics of his first hundred cases, "the immediate results in the advanced cases are not going to be such as to arouse enthusiasm on the part of surgeons; much of this will be due to the fact that I have been exploring an unknown field, risking too much perhaps, but always with the hope that if I could destroy the gross mass, the patient's natural defensive forces would take care of the present and future metastases. With increasing knowledge of what can be done with the otherwise utterly inoperable third-stage case by the application of heat, possibly by making use of a two-stage operation, by better judgment and better technic in their management, and following the hospital part of the treatment with prolonged and massive doses of x-rays, I am convinced that a degree of palliation will be obtained that is worth while."

There have been several cases reported during the past year in which the application of Percy's operation not only accomplished no good, but seemed actually to have done considerable harm, and in a review of this kind I deem it proper to call attention to at least one or two of these reports. For example, Bancroft² applied the technic to a case presenting a massive cauliflower carcinoma of the cervix and the patient died the next day with symptoms pointing toward a severe toxemia, and as the autopsy revealed no lesions due to error in technic, the cause of death was attributed to the operation. The microscopic examination of the uterus revealed certain islands of cancer cells showing advanced degenerative changes, reaching in many instances stages of necrosis and dissolution. Others show milder grades of degeneration and still others have apparently not been affected by the treatment. These latter cells have all the appearances of viable carcinomatous structures,

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 77.

² American Journal of Obstetrics, 1916, vol. lxxiv, p. 11.

but concerning the ultimate fate of even these well-preserved cells, Bancroft does not wish to commit himself.

Another interesting case is the one reported from the gynecological department of the Johns Hopkins Hospital by Leonard and Dayton,¹ in which rigid application of Percy's "cold iron" was ineffectual in eradicating the carcinoma and was followed by death after four days with lesions similar to those of extensive cutaneous burns. In this case, a woman, aged fifty-two years, with a hemoglobin of 56 per cent., presented on pelvic examination a cervix entirely destroyed by a rough, firm growth extending far out into each broad ligament, fixing the uterus firmly in the pelvis. In the treatment of this case, Percy's most recent technic was carried out in every detail. On the second, third, and fourth days after operation there was acute gastric dilatation. On the third day there was a urinary fistula, and on the fourth day a paralytic ileus, and during the preparation for enterostomy the patient suddenly died. At autopsy the stomach was found distended with gas; its mucosa was perforated by about twenty-four clean, round ulcers which measured from 1 to 7 mm. in diameter. Microscopically, the loss of substance extended to the submucosa and was unassociated with any cellular change. The operative site was extensively softened and much had sloughed away; grossly and microscopically intact squamous-cell carcinoma was found peripheral to large areas of general necrosis.

THE COMBINATION METHOD. Last year² we mentioned that some men, especially Clark and Gelpi, were treating cancer by a combination method, that is, they were performing an abdominal hysterectomy subsequent to the application of the Percy operation. The views of Clark³ have not changed since then, according to his report of 47 cases treated by this method. Nearly 70 per cent. of his cases were of the inoperable type, and whereas it is too early to report finally, a close follow-up system is being carried out and the results thus far attained warrant the position that since adopting this combination method, his results have been far better than with any other single method. He believes that it can be safely stated that there has been a definite increase in the operability and a decrease in the primary mortality in his clinic.

HIGH *versus* LOW DEGREES OF HEAT. To Percy is due the credit for enabling us to use heat more thoroughly and with greater safety by calling our attention to the opening of the abdomen and having one competent to guide our work with his hand in the abdomen, but to the late John Byrne, of Brooklyn, states Boldt,⁴ all credit is due to bringing the actual cautery treatment to our attention. Boldt has tried the Percy technic, but with unsatisfactory results. In addition to losing a patient from sepsis, he has shown by his experience that the carcinoma cells in the parametrium at a distance from the cautery are unaffected by the low degree of heat. He believes that the higher degrees of heat will give precisely as satisfactory therapeutic results, despite the car-

¹ Journal of American Medical Association, 1916, vol. lxvi, p. 1549.

² PROGRESSIVE MEDICINE, June, 1916, p. 218.

³ Texas State Journal of Medicine, 1916, vol. xii, p. 132.

⁴ American Journal of Obstetrics, 1916, vol. lxxiii, p. 1.

bonization, as the lower degrees, in fact, one may destroy deeper and more rapidly with it, hence it is superior to use for first cauterization. There seems to be a tendency among many other men to return to the use of higher degrees of heat than those recommended by Percy, and it is likely that in the next year or two there will be considerably more discussion upon this subject.

BEEBE'S AUTOLYSIN TREATMENT. It will be remembered that the autolysin treatment¹ for cancer was not inaugurated under very auspicious circumstances, since almost simultaneously with the appearance of Beebe's optimistic reports and extravagant claims came the cruel lash of true scientific criticism. Apparently no one realizes this more than Beebe² who now states that he never intended the treatment as a cure but merely as a palliative measure, and, as an evidence of his altruistic spirit, he gives the ingredients, dosage of each and method of preparation of his pet product. He states that it has been applied in over 2000 cases and some very marked beneficial results have been attained, in fact, he claims that 80 per cent. of the patients who have taken the treatment have been benefited to some degree.

The other side of the question has been presented by Wood³ who experimented with autolysin on twenty-one mice bearing spontaneous tumors. As a preliminary, test injections were made on normal mice to determine the toxicity of the autolysin. The dose orally suggested for these animals by Drs. Beebe and Horowitz, who supplied the autolysin used in this study, was from 3 to 5 minims, or the equivalent of 7200 minims in a 150-pound man. Clinically, there was no evident change in the condition of the animals as the result of the treatment. Their weight fluctuated within about a gram, as is the case with untreated mice bearing spontaneous tumors. No gross changes were observed in the tumors which were not also found in neoplasms from untreated controls. Wood concludes that "autolysin," either in small or in very large doses, does not affect malignant tumors in mice.

Surgical Treatment of Uterine Cancer. Although radiotherapy and other non-operative methods of treatment of uterine cancer have been enthusiastically supported by numerous surgeons, there is a consensus of opinion, in this country at least, that operable cancer still belongs to the group of conditions in which surgery is indicated. With regard to the borderline cases, however, there is a division of opinion and in order to determine the direction in which the pendulum is swinging, I shall quote the more recent opinions and results of several leading gynecologists. Taylor⁴ advises the radical operation in the treatment of carcinoma of the cervix for the favorable case, that is, a patient in a good general condition, an abdominal wall without an excess of fat, and no associated pelvic lesion to increase the operative risk, and a limited growth. For a limited growth in a patient who is a bad risk on account of general or local conditions, he usually advises a simple abdominal

¹ *PROGRESSIVE MEDICINE*, June, 1916, p. 221.

² *New York Medical Journal*, 1916, vol. ciii, p. 361.

³ *Journal of American Medical Association*, 1916, vol. lxvi, p. 94.

⁴ *Surgery, Gynecology and Obstetrics*, 1916, vol. xxii, p. 70.

hysterectomy, occasionally a vaginal hysterectomy. For the so-called inoperable case, he advises radium, x -rays, and the cautery; in this class because of the favorable reports that are published following the use of radium, x -rays, and the cautery, he includes cases that he formerly submitted to operation.

In speaking of a simple or a radical operation for carcinoma of the uterus, the question is raised as to what constitutes the difference between these operations. Theoretically, there is a great difference—practically, one merges into the other. In one operation, vessels are ligated close to the uterus and no attempt is made to remove any of the pelvic connective tissue; in the other operation the ureters are exposed, the vessels are ligated outside of the ureters close to the pelvic wall, and a large amount of pelvic connective tissue and a large portion of the vagina is removed. Practically, in some cases, because of technical difficulties, because of hemorrhage which is difficult to control and the general condition of the patient, the theoretical operation ends with the removal of the uterus and a comparatively small amount of surrounding connective tissue. The higher primary mortality of the radical operation, according to Taylor, is not due entirely to the operation itself. It must be remembered that every series of radical abdominal hysterectomies contains cases that were too far advanced for removal by a simple hysterectomy. For a simple hysterectomy, the growth must practically be limited to the uterus itself, while a moderate involvement of the broad ligaments is not an absolute contra-indication to the radical operation. For growths of the same extent in patients in whom the radical operation is not contra-indicated because of constitutional disease or thick abdominal wall, Taylor believes that the primary operative risk is only moderately greater for the radical than for the simple hysterectomy, and is not sufficient to outweigh the advantages of the more extended operation. In his own cases, the primary mortality was about 15 per cent., some of these deaths resulting from operating on cases that were really inoperable because of the advanced state of the disease, and he believes that the mortality will be less in the future with a more careful selection of cases.

OBSERVATIONS AT THE MAYO CLINIC. Basing his views on a review of 634 cases of cancer of the uterus operated upon in the Mayo Clinic during the past ten years, Balfour¹ states that patients with cancer of the cervix not too far advanced and who are good surgical risks should be treated by thorough cauterization of the local disease in the cervix, and total abdominal hysterectomy of the Wertheim type. When cancer is confined to the cervix, the vaginal outlet fairly lax, and the patient is a poor surgical risk, *i. e.*, obese, with cardiorenal disease, etc., the preferred treatment is the clamp and cautery vaginal hysterectomy. In the more advanced stages of the disease, if the patient is a good surgical risk, the two-stage operation should be done, *i. e.*, the Percy method of tissue coagulation by heat followed, after some weeks, by total abdominal hysterectomy. If the patient is a poor surgical risk,

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 74.

the Percy method should be applied, but the abdominal hysterectomy should be considered on its merits in the individual case. In most instances of cancer of the *body* of the uterus, a total abdominal hysterectomy should be done. In the small minority of patients with cancer of the body of the uterus who are poor surgical risks, clamp and cautery vaginal hysterectomy may be indicated. Balfour calls attention to the well-known fact that with cancer in any part of the body, secondary infection is an important factor in the spread of the disease, and consequently in the immediate and end-results of operation. Malignant disease of the cervix is a good example of this septic type of cancer, statistics showing that in 40 per cent. of individuals dying from cervical cancer no evidence of metastasis is found. The infection, as shown by Rosenow, is usually streptococcic, and any surgical measure which does not at the same time sterilize the growth and the surrounding tissues is open to serious objection. A study of the results following the older types of operations for cancer in any septic situation shows a high relative mortality from the disease, depending as much on the degree of infection as on any other factor, and herein lies the justification for the clinical belief in the use of the actual cautery. Of the various operations from cancer of the uterus, there is no doubt that total abdominal hysterectomy, as popularized by Wertheim, is the most radical surgical procedure we possess for dealing with the disease, and no method gives higher percentages of permanent cures, especially if preceded by cautery sterilization of the primary lesion. One must, however, give serious consideration to certain indisputable facts associated with this operation; the primary mortality is higher than in any other method, immediate complications, such as ureteral and other fistulæ, are relatively frequent, while late complications, such as pyonephrosis, are not rare. Balfour believes it possible that the primary mortality can eventually be reduced to less than 10 per cent. by improvement in surgical technic. The possibility of fistulæ can also be greatly minimized, especially if the practice is followed of completely or nearly closing the abdominal cavity and not packing the pelvis with gauze brought out through the vagina. Since the use of gauze packing has been discontinued in the Mayo Clinic, no fistulæ have developed.

Another plea for the radical operation in the treatment of carcinoma of the cervix has been made by Sampson,¹ who insists upon a wide removal of the parametrium. He has previously shown that in 27 cases in which the parametrium was removed, it was involved by cancer in 17 instances; 8 times by direct extension, 3 times by metastases in the lymph nodes, and in 6 cases by both forms of invasion. In the last ten years he has operated upon 40 cases of carcinoma of the cervix by means of a modified Wertheim operation, with the immediate loss of 7 patients, a primary mortality of 17.5 per cent. In 5 of the 7 cases, although they died in shock, the real cause of death was lack of judgment in attempting to operate upon cases that were too far advanced. Fifteen patients of this series were operated upon from five to ten years ago;

¹ New York State Journal of Medicine, 1916, vol. xvi, p. 62.

of these, 4 died from the operation, 7 are living and apparently free from cancer at the present time, making 63 per cent. of apparent cures, or if all 15 cases had survived the operation, the percentage of cures would have been at least 46 per cent.; 4 cases died from recurrences. Sampson is very enthusiastic over the apparent beneficial effect following the use of sand-bags in postoperative shock or in cases where he fears postoperative peritonitis in which he wishes to splint the abdomen and keep it quiet. These bags are made of ticking about 11 inches long and 5 or 6 inches wide. They are loosely filled with from 4 to 5 pounds of sand, and are placed on the abdomen after the patient returns from the operating-room before she comes out of the anesthetic. To splint the abdomen and exert moderate pressure, two bags are used, placed transversely one above the other. If more pressure is desired, as in marked shock, the number of bags may be increased, though it is rarely necessary to employ more than four bags. These bags are worn as long as the condition of the patient indicates their use, and are gradually removed. The majority of patients not only tolerate them but even like them, and will insist upon wearing one or two of them much longer than necessary. They are especially appreciated by the patient in coughing and vomiting, as they support the abdomen, but they are contra-indicated if abdominal distention due to tympanites is present.

The American Gynecological Society, at their meeting in Washington in May, 1916, devoted considerable time to a symposium on cancer of the uterus. At this meeting Peterson¹ presented a report of his results along this line in his clinic at the University of Michigan. Experience with the radical abdominal operation for cancer of the uterus confirms his belief that it is an exceedingly dangerous procedure and will always be attended by a high primary mortality. Even if the percentage of operability of cases of cancer of the uterus markedly increases in this country and elsewhere, there will always be borderline cases attended by a high primary mortality, because it is not always possible, even with the greatest care in the examination of the patient prior to operation, to estimate the extent of the disease. Errors in judgment mean death from shock if the disease be too far advanced, or if the operator fails to complete the radical removal of the cancerous uterus. However, in spite of the high primary mortality, Peterson believes that it is the only procedure, with the possible exception of the extended vaginal operation, which holds out any reasonable promise of a permanent cure. Primary and end-results of the radical operation for cancer of the uterus must be considered together in order to judge the good accomplished in a given series of cases. Unless the operations be radical, the end-results will be poor, and if they be radical the primary mortality must be high.

Since 1912, his experience with 14 ordinary panhysterectomies for cancer of the fundus shows worse primary and end-results than in 11 cases previously reported where radical removal was performed. This showing leads to the conclusion that because carcinoma of the fundus is

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 237.

more easily cured than when the cervix is involved, we are not justified in thinking that it can be treated any less radically than carcinoma of the cervix. The primary mortality in 59 cases of cancer of the cervix and fundus treated by the radical abdominal operation was 25.4 per cent. The end-results, however, in 51 patients operated upon five or more years ago were most gratifying, combining cervix and fundus cases; 27 of the 51 patients were alive and well after five years, or 56.2 per cent. of all cases operated upon, while 69.2 per cent. of all those surviving the operations were alive after five years. Of 40 cases of cancer of the cervix operated upon more than five years ago, 18 are alive and well, or 47.3 per cent. of the total number, or 62 per cent. of those surviving the operation remain cured. These percentages were obtained by Wertheim's formula, in which all patients who die from intercurrent disease or who cannot be traced must be subtracted from the total number of operations to ascertain the percentage of permanent cures in all cases operated upon. To obtain the percentage of permanent cures of those surviving the operation, the number of patients living five years or more after the operation must be divided by those surviving the primary operation after deducting those dying of intercurrent diseases and the number not traced. In spite of attempts to educate the public regarding cancer, the cases of cancer of the uterus seen by Peterson during the past four years were more advanced than formerly. During this time he has seen 124 cases, in 36 of whom the disease was so far advanced that operation was refused or nothing was done. The cautery method was tried in 58 cases and proved valueless except as a palliative measure. He feels, therefore, that in spite of the high primary mortality, the end-results in those surviving the operation should encourage us to continue with the procedure in suitable cases.

A REPORT FROM ENGLAND. Of much interest is the recent report of Berkeley and Bonney¹ coming, as it does, from an English source, for as they themselves state "This series of 100 cases of radical extirpation of carcinomata of the cervix uteri reviewed on an absolute cure basis is the first to be produced from a British source, all previous evidence as to the final value of the operation having come from the Continent. The attitude of characteristic cautiousness which distinguishes this country in taking up innovations from abroad extends to surgery and there are not wanting those who still view the procedure askance or even with hostility." The operation, as performed by these surgeons, consists of the removal of the uterus with its cervix contained in a bag formed of the upper half or two-thirds of the vagina closed by a clamp designed for the purpose. Together with the uterus and upper portion of the vagina are removed the ovaries, Fallopian tubes and broad ligaments, the parametric and paravaginal tissue down to the upper surfaces of the levatores ani, and the glands and cellular tissue occupying the obturator fossæ and investing the external and internal iliac arteries and veins. To effect this wide clearance, the ureters are entirely isolated throughout the anterior two-thirds of their pelvic course and in certain

¹ British Medical Journal, 1916, vol. ii, p. 445.

cases part of one ureter has been deliberately resected, and the upper end implanted into the bladder. On certain occasions, a portion of the bladder has been excised in cases in which separation of that viscus from the cervix was impossible by reason of advanced growth. In cases in which the glands about the external iliac artery and vein are obviously carcinomatous, the dissection was extended up to the bifurcation of the aorta. They figure their operability rate as 62.5 per cent., or, in other words, they operate 100 out of 160 patients presenting themselves.

Results. Subtracting from the 100 original cases the 7 lost sight of and the 2 that died from intercurrent affections, the cured cases represent 42.8 per cent. of the 91 original cases in whom the final outcome is known. On this same basis, of the 71 cases that survived the operation 54.9 per cent. were cured, and of the 151 cases originally presenting themselves for operation, 25.8 per cent. were cured. In every case the regional lymph glands removed at the operation were microscopically examined and in 35 cases they were found to be malignant. These 35 cases show a much higher operative mortality and a much greater percentage of recurrences than do the 65 cases in which the regional glands were not malignant, but nevertheless a certain proportion of them are cured, as may be seen from the following table:

	Glands carcinomatous.	Glands not carcinomatous.	Total.
Died of operation	9	11	20
“ recurrence	16	16	32
“ other diseases	1	1	2
Lost sight of	2	5	7
Cured	7	32	39
	<hr/> 35	<hr/> 65	<hr/> 100

Of the 32 cases of recurrence, death occurred as follows: 4 cases under one year; 11 between one and one and a half years; 5 between one and a half and two years; 5 between two and two and a half years; 1 between three and three and a half years; 5 between three and a half and four years, and 1 between four and four and a half years. As a concluding word in their report, Berkeley and Bonney state, “That we were able to cure 7 patients in whom the regional glands at the time of operation were already carcinomatous, justifies the operation even in advanced cases.”

A STATISTICAL STUDY OF OPERATIVE RESULTS from various clinics throughout the world has been presented by Jacobson,¹ which is of considerable interest but does not readily lend itself to abstracting. One of the tables presented, however, is of special interest in that it compares the work of ten noted gynecologists with the latest obtainable report of Wertheim's work. From this table we note that the combined report of the ten surgeons represents 566 operations for carcinoma of the cervix with a primary mortality of 23.11 per cent. or 131 cases and 144 cases cured after five years, or 25.44 per cent. As opposed to this we note that Wertheim reports on 714 operations with a primary mortality of 16.6

¹ Journal of American Medical Association, 1916, vol. lxxvii, p. 1219.

per cent., and 53.3 per cent. of five-year cures. Actual figures mean very little without an intimate knowledge of the cases in question, but it is gratifying to note that the percentage of five-year cures is gradually increasing.

PERSONAL VIEWS ON THE TREATMENT OF CANCER OF THE UTERUS. As I¹ have already stated, the treatment of cancer of the uterus—that will-o'-the-wisp of surgery—has for the last three decades been a bone of contention as regards the best method of circumventing the growth by surgical methods. The various forms of hysterectomy have been thoroughly tested, beginning, first, with the simple vaginal method, a large series of cases having been thus treated having been reported from American and European clinics. The final summary of results, however, after a probationary five-year period, showed the treatment to be lacking in effectiveness, first because it was applicable to only a relatively small number of cases and second, because the percentage of ultimate cures it yielded was lamentably small. Then came Schuchart's more radical vaginal hysterectomy, which in the hands of a few experts, among the foremost of whom is Schauta, has given a larger rate of ultimate cures; it is, however, a difficult operation and is attended by a larger mortality, and is followed by serious vesical and ureteral sequelæ. Because of these objections, this method has received only limited approval from gynecologists. Following this, the extended or more radical abdominal method came into vogue, and until three years ago continental gynecological literature was replete with the reports of cases from many clinics containing both favorable and adverse criticism. About three years ago these reports suddenly ceased, to be almost entirely superseded by the consideration of radium and mesothorium as new and promising therapeutic agents.

As a convincing evidence of the limitations of surgical applicability, we offer the results of our experience. In less than two years we have treated over 50 cases of inoperable cancer of the uterus with radium and during the same period only 12 cases have been considered as within radically operative limits. During the preceding ten years the number of radical operations performed was about 60. In other words, for 50 cases subjected to operation, at least 250 have been abandoned as hopeless. This personal observation has convinced us, more than ever before, of our grave shortcomings as regards the surgical treatment of uterine cancer. Although the radical operation has given the best ultimate statistics, so far as the number of permanent cures is concerned, experience has proved that, beyond doubt, it is also attended with an unavoidably high primary death-rate.

The therapeutic problem involved in the successful treatment of carcinoma of the cervix is based upon the stage of invasion of the new growth. The results of the radical operation have proved conclusively that, with very rare exceptions, the hopeless cases are those of the metastatic type. All the methods now being employed are, therefore, directed toward the radical elimination of the local cervical and vaginal

¹ *Annals of Surgery*, 1916, vol. lxiv, p. 601.

disease process. If the growth has invaded the parametrium to a point beyond the outer limits of the ureters, or if it has found lodgment in the iliac glands, the case must, with rare exception, be regarded as hopeless so far as surgical extirpation is concerned. No operation as yet suggested has been more generally misapplied than has the so-called radical abdominal operation. This may be proved to one's own satisfaction by examining the specimen exhibited, as a rule, as the product of this operation. This criticism is directed not only to the work of other surgeons, but applies with equal force to my own. There can be no more difficult surgical procedure than the radical operation for the removal of a cancerous uterus, for the efforts of the operator are impeded on all sides by insuperable limitations.

We are all fairly well satisfied with the results of operation in cancer of the fundus, whereas no one regards the operative treatment of cancer of the cervix with any great degree of optimism. To attain a high measure of success, some more efficient means than the scalpel must be employed. That this remedy has not as yet been discovered is shown by the fact that almost every surgeon who has made a special study of this subject very properly advocates the same principle here as has been adopted in cancer of every other part of the body that is accessible to radical surgical measures. Notwithstanding the remarkably good results that have followed the use of radium, I still adhere to the dictum that the uterus and all possible adjacent tissue, if the growth is very limited in its extent, must be extirpated. Beyond this point, however, I have grown quite conservative. My first recession occurred eighteen years ago after visiting Saenger's clinic. I found that this very clever surgeon and clear thinker had even then abandoned hysterectomy as a palliative measure in widely extended cancer, on the ground that practically no hope of cure could be offered the patient, and that removal of the uterus actually intensified her subsequent suffering. Following a hysterectomy, if carcinomatous tissue is left in the parametrium, the patient's postoperative state is likely to be worse so far as pain is concerned, for it is usually severer and therefore more prolonged than if the uterus is allowed to remain *in situ*. With the removal of the uterus, the elastic broad ligaments and parametrium retract and cling closely to the pelvic wall, coming in contact with the large pelvic bloodvessels and the sacral plexus. If the growth remains in this situation, the condition is infinitely more painful than if it is held in suspension by the broad ligaments away from the pelvic wall. The crux of the situation, as our experience has taught, is to attempt surgical measures only in the clearly operable cases, leaving the large remainder to secure relief from therapeutic efforts, which give as good or, as we now believe, even far better results, with the use of radium.

In the inoperable cases, I believe the Percy cautery holds out a distinct hope; nevertheless, I do not share the great degree of optimism shown by the inventor of this method as regards the cases of wide-spread extension. In using the cautery, as in performing the radical operation, the anatomical barriers are the same and I am firmly convinced that its general adoption will be followed by even a larger number of serious and

wretchedly disabling sequelæ so far as the rectum, bladder and ureters are concerned. This cautery should be used only by the skilled specialists, for it is not safe in the hands of the novice; even in skilled hands, accidents are prone to occur in many instances. Moreover, one cannot get away from the fact that the Percy method is most radical, involving an abdominal section, ligation of the internal iliac arteries—a procedure that may be quite difficult in some cases—and the prolonged exposure of the patient to the slow desiccation of the tissues. Because of the fact that a sufficient quantity of radium was at our disposal at the University Hospital, we have followed this line of treatment almost exclusively and we have had, therefore, but a limited experience with the desiccating method.

In this country the *x*-rays have not had sufficient trial to give them a place of even tentative value. To Bumm's clinic, from which very favorable preliminary reports were issued, we looked for an elaboration of technique that would serve as a standard for comparison with radium and mesothorium. The Great War has, however, put an end to all investigation in the gynecological clinics of Germany, and it is only from the hospitals of the Continent, where there is an abundance of material and a willingness to risk much, so far as individual patients are concerned, to work out a theoretic principle, that we may expect authentic reports of hazardous novel procedures. The röntgenologist cannot be depended upon for convincing reports, for his cases are drawn from widely divergent sources, and too often the clinical diagnosis is accepted and no microscopic control attempted.

As to radium, I am convinced from our experience at the University Hospital that it offers the most helpful outlook of any remedy thus far presented in the palliative and occasionally the curative treatment of the borderline and inoperable cases. In our series of over 50 cases, we have thus far had one patient in whom a fistula developed; this followed a radical operation in which 50 mg. of radium were left within the vaginal cuff for eight hours, another application being made in six weeks. In this case there was no apparent retardation of the growth; on the contrary, great sloughing holes appeared in the rectum and bladder within two months. Whether these were caused by the radium or were due to the rapid growth of the carcinoma, we were unable to determine. In practically every case radium has been applied for twenty-four hours, and the patient has usually returned home the next day. So far as any immediate effect is concerned, in no instance have we witnessed any untoward symptom beyond a fleeting degree of nausea, and this but rarely; only in one case did a high temperature develop, and this was in a case in which the Percy cautery had been applied extensively, and was followed by a twenty-four-hour application of radium. With these two exceptions there have been no disagreeable effects in our series, although, of course, fortunately we have not had to pass through the experimental stage of this treatment, but have profited by the mistakes of the early workers. Thus far we have found an 85 to 100 mg. dosage quite satisfactory, but it is possible that still better results may be achieved by larger amounts.

We have adhered strictly to one rule, namely, never to attempt an operation on any case that has been healed locally by radium. It appears to us a most unwise surgical policy to subject a patient to the grave hazards of a radical operation, after the radium has acted beneficially, in a fatuous attempt to secure still more effective results. With further experience, we may modify this rule, but up to the present, we have not seen the slightest evidence in favor of so apparently unwise a policy. Radium, as is shown in our series of cases, is by no means a universal panacea for cancer, even when the growth is strictly localized and there is no way of determining which cases will be benefited by its use. There is beyond doubt a certain percentage—how small or how great we cannot tell from our experience—in which cancerous growths are not retarded by radiotherapy; indeed, occasionally it would appear that there is a positive acceleration of the growth. That many cases show an astounding improvement and local cure cannot be gainsaid. In our series several instances occurred in which the results achieved were so remarkable as to be almost incredible. Whether in these cases the fire is but smouldering and may break out sooner or later with renewed violence, time alone will tell. In the discussion of these cases the question of hospital economics must not be lost sight of. The length of stay in the hospital following a radical operation will average at least three weeks, whereas after the application of radium, not more than three days will be required. When complications arise after radical operations they are usually serious, entailing much suffering. Such patients, on returning home, are likely to remain semi-invalids for several weeks and when there is a rapid continuation of the disease, they become a heavy burden to a poor family. In the comparison of statistics, this difference between the two classes of patients is greatly in favor of those treated by radium, a fact that tends to incline us strongly to the use of radium in borderline cases, which we formerly subjected to a radical operation.

Removal of the uterus in cases of cancer of the fundus has yielded such good results that I do not feel we are justified in taking any chances with radium, not even in the borderline cases. *Our attitude toward the cervical and fundal growths is diametrically opposite. In borderline cases of cancer of the cervix we invariably employ radium. In advanced cases of cancer of the fundus we invariably perform a hysterectomy.* A pessimistic view dominates our outlook in the surgical treatment of the cervical growths if the pathological process is at all advanced, whereas fundal growths may be viewed with a cheerful optimism even when the cancerous process is extensive. As a palliative agent, we may assert with full assurance that we have never obtained results with any other method that even approached in beneficence those secured by radium. The cloud, however, that hangs over the remedy is the danger of unbridled optimism.

REMOVAL OF CANCER BY CURETTAGE. It is curious how a report of an unusual surgical case or condition is frequently followed by reports of similar cases by other observers. Thus, last year¹ Ladinski's report

¹ PROGRESSIVE MEDICINE, June, 1916, p. 224.

of 3 cases of carcinoma of the fundus in which the cancer was entirely removed by the curette, seemed to have called the attention of the profession to such a possibility and we now have a further case to record. In this case, which has been reported by Frank,¹ curettage performed by another physician showed voluminous adenocarcinoma with invasion of the uterine wall. After a prolonged and difficult hysterectomy, from which the patient almost lost her life, the uterus obtained appeared to show only a few small fibroids and only after careful search were small microscopic areas of cancer found. This case is of interest because it bridges the gap formed by such cases as were reported by Ladinski in which no carcinoma could be found after curettage (and in which, Frank believes, the question of a mistake in diagnosis or a mixing of specimens in the laboratory always arises). The surgeon is necessarily put upon the defensive when an organ removed for malignant disease shows no gross lesions, and should microscopic examination prove negative, as might well happen, a degree of unpleasant uncertainty exists. Perhaps this fact accounts for the rare appearance in the literature of reports of similar cases.

Ectopic Chorio-epithelioma of the Pelvis. Another most interesting and instructive case reported by Frank² is that of a married woman, aged thirty-two years, who had been in poor health for five months preceding admission. Her menses, which had always been regular, were occurring irregularly every six or seven weeks during this time, and she complained of a moderate amount of pain in the lower abdomen and some backache, and also slight pain on urination. Upon examination, the following abnormalities were found: Considerable emaciation, a blowing systolic murmur at the apex of the heart; tenderness in the right lower abdominal quadrant on deep palpation; a deep cervical tear, uterus enlarged and firmly fixed, behind and to the right of it—a fluctuating mass reaching into Douglas's pouch with upper limit undefined. While in the hospital, the patient was observed for eight days, during which time the mass increased in size and the temperature rose to 101°. Aspiration of the pelvic mass was performed through the posterior fornix and pure bright blood was obtained without much suction. The fornix was at once incised, allowing exit to a solid stream of arterial blood. The abdomen was opened immediately and an enormous hemorrhage was found coming from the depth of the pelvis, apparently arising from the right pelvic wall, in the neighborhood of the right sacro-uterine ligament, which was not controllable by strong pressure. In order to expose the depths of the broad ligament, a rapid clamp hysterectomy and right salpingo-oöphorectomy were performed, but no spurting vessels could be seen. The aorta was then compressed and a ragged area about the size of a silver dollar was exposed in the region where the sacro-uterine ligament, ureter and division of the internal iliac vessels are situated. Considerable of this tissue was removed, and the bleeding was controlled by deeply placed chain ligatures. The patient died shortly after the operation and autopsy was refused. The

¹ American Journal of Obstetrics, 1916, vol. lxxiv, p. 369.

² Ibid., p. 372.

pathological report of the pelvic organs stated that the uterus and adnexa were normal while the neoplasm was a typical chorio-epithelioma.

Pathologically, several very interesting questions arise in this case. The primary site of the tumor could not be found; the uterus, which was normal, showed no decidual reaction; the adnexa were negative; either primary or secondary implantation of an ovum can be excluded by the fact that serial section of the invasive portion of the mass showed no villi. Etiologically, a previous gestation must be considered and Frank believes that during the pregnancy fetal cells must have been carried

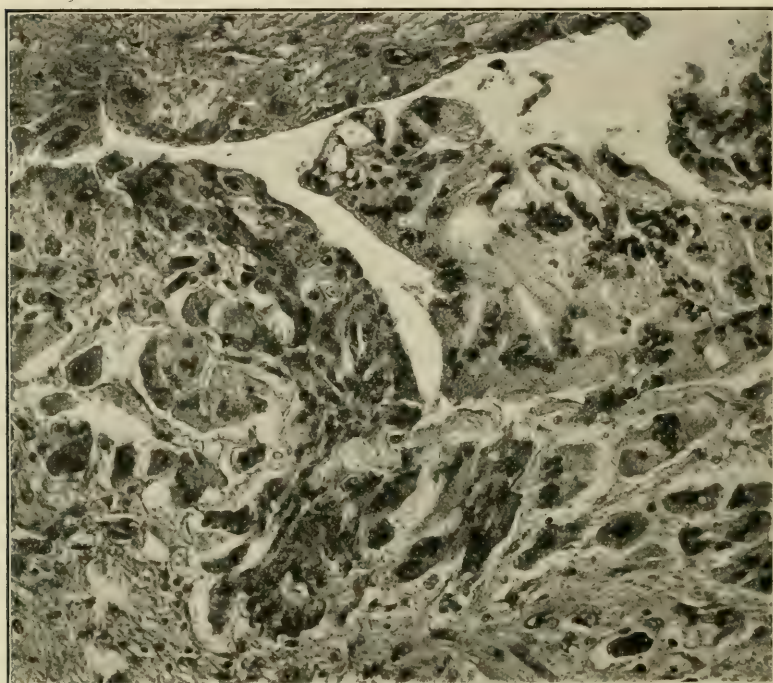


FIG. 73.—High-power view showing chorio-epithelioma. (Frank.)

away and deposited by the blood stream at the site found at operation. Here the chorio-epithelioma developed, small repeated hemorrhages occurring and being encapsulated in Douglas's pouch as happens in ectopic gestation.

NON-MALIGNANT CONDITIONS OF THE UTERUS.

Radiotherapy. At the meeting of the Pennsylvania State Medical Society in September, 1916, Keene presented the experiences and results with radium as noted in our clinic at the University Hospital. Leaving aside the cases of cancer, since we have already considered that subject, we have a series of 47 cases consisting of patients who have been treated for uterine hemorrhage of myomatous or myopathic origin, there being

24 cases of myoma and 23 cases of myopathic hemorrhage. In no case was the tumor of large size and in every case the only symptom was excessive bleeding.

Technic. In every case a preliminary curettage was performed and the curettings examined in order to eliminate the possibility of carcinoma of the fundus. The radium, protected by platinum and rubber, was inserted into the fundus of the uterus where it remained for from eight to thirty hours. In by far the larger number of cases the limit of application was twenty-four hours and the amount of radium used was 50 mg. As a rule, the patients were discharged in from three to five days after operation.

Results. As in the cancer cases, nausea and vomiting not infrequently are present for one or two days. Occasionally, a slight elevation of temperature ensued, and in one instance 103° was reached, but, as a rule, the convalescence was marked by no disagreeable symptoms. In not a single instance has there been a failure to check the bleeding; 4 cases were women between twenty and thirty years of age in whom the application was made for only eight hours, with reduction of the excessive menorrhagia to the normal flow. In the remaining cases total amenorrhea followed at intervals varying from two to nineteen months. We have noted that complete cessation of bleeding may follow immediately, there may be one or two scanty periods, or a slight irregular bleeding for a few weeks may occur before the complete establishment of amenorrhea. Rarely, after several months have elapsed, a scanty flow will be seen only to be followed again by amenorrhea, but this occurred in only 3 of our cases. We have been very much interested in the effect of radium on leucorrhea. Our results show that, in the majority of cases, no discharge follows. A profuse discharge may be present for a few weeks, but this rarely occurs and has not been permanent. Ten patients who had a profuse leucorrhea before the application of radium have been entirely relieved. In this we have been agreeably surprised since we feared that the extensive changes in the endometrium and uterine bloodvessels, might produce conditions leading to a permanent and troublesome leucorrhea. Abdominal or pelvic pain has followed in 3 cases, coming on immediately after the application, being colicky in nature and completely disappearing in ten days. Menopausal symptoms of varying degrees have developed in 10 cases. The only ill-result occurred in a case of chronic pelvic inflammatory disease, whose chief complaint was excessive and irregular menstruation. Here there was evidently a lighting up of the old process, since two days after the application the patient developed the symptoms of an acute pelvic peritonitis, and, at operation a few weeks later, the findings were those of an old infection with a superadded acute process.

As a result of our experience, we believe that radium is the treatment of choice in all cases of uncomplicated, small interstitial or submucous myomata whose only symptom is hemorrhage. In this class of cases, as well as in myopathic hemorrhage, 100 per cent. of cures can be expected. Sufficient dosage will produce complete and permanent amenorrhea which will come on immediately or may be preceded by

one or two scanty periods. Irregular bleeding due to pelvic inflammatory disease, tumors of large size or tumors of any size with associated disease of the adnexa or surrounding structures are to be treated by appropriate operations and not by the application of radium. In this brief report, Keene has stated the facts as presented by an unbiased analysis of our cases. Our conclusions of today may be entirely changed by our experience of tomorrow for the work is still in the experimental stage and final conclusions can be reached only after years of accumulated evidence.

A Small Series of cases in which radium has been applied has been reported by Miller.¹ He has used radium in 10 cases of menopausal bleeding in women between the ages of forty and fifty, and, in all of the cases, the bleeding was checked by a single application, although it was quite severe before treatment was begun. In 5 women, between the ages of twenty-five and thirty-six years, complaining of hemorrhage, the results were good. In 10 cases, radium was used to check severe bleeding due to myomata of the uterus. All of the patients were relieved by a single application except in 1 case, and here a second application brought the desired result.

Röntgenotherapy. The advent of the Coolidge tube has placed the whole domain of röntgenotherapy on an absolutely new basis. The time has now come when it is possible to prescribe the exact dose of radiant energy which it is desired to administer over any prescribed area and it is now possible for one röntgenologist to tell another what has been done in any given case where results have been obtained. According to Johnston,² it is now possible to give at a single sitting, at a single portal of entry, approximately thirty times the old-time dose. The x -rays have been employed in gynecology for a sufficient length of time to allow the profession to form an accurate idea of the merits and demerits of this method of treatment; nevertheless, opinions vary greatly on this subject.

Frank³ has used the x -rays for a number of years, never giving the exposures himself but always referring the patients to the same röntgenologist and in his paper, which was written "to defend x -ray therapy from its friends," he states that properly employed, in properly selected cases, the treatment is invaluable and indispensable in gynecology; used promiscuously by the uninitiated, röntgenization is as dangerous as the surgeon's scalpel in the hands of the ignorant and the meddlesome. It enables the gynecologist to exert graded effects upon the ovary, and thus control the menstrual cycle in degrees varying from slight inhibition to permanent destruction of function. It produces amenorrhea by destroying the ovarian follicular apparatus or oligorrhea by partial destruction of follicles. The resulting menopause symptoms correspond in character and degree to those of the postoperative menopause. We have a choice of two methods of application. First, the fractional treatment, which implies exposure to the rays for four to six minutes of one or more large fields in the lower abdomen, two or

¹ Southern Medical Journal, 1916, vol. ix, p. 328.

² American Journal of Röntgenology, 1916, vol. iii, p. 84.

³ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 243.

three times weekly over long periods of time. Such graduated dosage, though slow of effect, usually admits of accurate control of the degree of influence exerted upon the ovaries. It is, therefore, especially recommended for cases in which reduction of bleeding and not amenorrhea is desired. Second, we have the intensive treatment, which, according to the improved Freiburg technic, permits of the use of enormous doses at each sitting (small multiple fields, filtration, cross-fire and lately also the Coolidge tube). By this means amenorrhea may be achieved within a short period of treatment (nine to eighteen weeks). This form of treatment is applicable to cases in which profuse bleeding must be controlled within a short period of time.

Obstinate cases of hemorrhage in adolescents can be cured by röntgenotherapy, but Frank believes that only such cases as have resisted all other forms of therapy should be selected. Functional hemorrhages during sexual maturity, if conditions are unmistakable and curettage shows absence of carcinoma, may be relieved by producing oligorrhea (with the possibility of subsequent pregnancy), or definitely cured by inducing the artificial menopause. Prelimacteric functional hemorrhages are readily cured by the production of the menopause. At this age, malignancy must be even more carefully guarded against. Uterine fibroids may be slowly reduced by x -ray treatment, but all complicated cases should be excluded, as otherwise serious, or fatal, mistakes may occur. This class of cases has given rise to the largest amount of discussion. Kroenig and Gauss claimed 100 per cent. cures where the method was used, and an applicability of 85 per cent.; Frank, on the other hand, finds an applicability of only 5 per cent. in his material. In properly selected cases (5 to 10 per cent.), the choice between operation and röntgenotherapy may be left to the patient, while in patients with serious heart lesions, nephritis, or pulmonary trouble, or in the hyperneurotic, preference should be given to the x -rays. The main danger to be apprehended in x -ray treatment is their application by error to malignant tumors. Such danger is minimized by excluding cases which present doubtful or complicated findings. Hence the treatment must always be controlled by the trained gynecologist, because diagnostic accuracy is far more essential than if operative measures are contemplated. X-ray treatment can be given to the impecunious only in well-equipped and well-endowed institutions. In addition to the initial expense of the installation, the operator's time, the electricity consumed and the replacement of tubes, etc., produce a formidable expense account. Fractional exposures (four to six minutes) cost approximately three dollars each to cover expenses and may have to be continued two or three times a week for many months. Intensive exposure, sufficient to produce amenorrhea and shrinkage of a fibroid in a woman over thirty-five years of age, will cost from one hundred to three hundred dollars at a minimum.

Another report from a surgeon on röntgenotherapy is that of Corscaden¹ who states that in 20 women over thirty-eight years old, suffering from

¹ American Journal of Obstetrics, 1916, vol. lxxiii, p. 23.

uterine bleeding, whether possessing fibroids or not, complete amenorrhea occurred from the onset of treatment in 5 per cent., after one period in 5 per cent., after three periods in 5 per cent., and after two periods in 85 per cent. The first period after the institution of treatment is occasionally profuse. All of the cases were severe enough to partially or completely incapacitate the women, nevertheless, activities were resumed usually about three weeks after the first exposure. Severe untoward effects occurred in only 2 cases; one suffered from nausea and diarrhea, the other from diarrhea indistinguishable from mucous colitis. Many women felt fatigued for a day or two, and a few suffered from headaches; albumin and casts appeared in the urine of one woman. Corsecaden believes that all myomata, which do not constitute an immediate or remote menace aside from that of hemorrhage, are proper subjects for the production of the menopause provided that ulcerative changes or pedunculated fibroids or polyps do not exist, and provided that the possessor be over thirty-seven years of age. All myomata occurring in women under thirty-eight years of age should be excised rather than be subjected to the x -rays unless operation is contra-indicated. *An adverse opinion* regarding the treatment of myomata by means of röntgenotherapy is voiced by Stein,¹ who has reviewed the literature rather thoroughly, and quotes many cases in which the x -rays failed to cause the disappearance of a myoma, and, upon operation, sarcoma, in some instances inoperable, was found. He believes that this is sufficient evidence against the radiation treatment of myomata except in the rarest instances.

View-point of the Röntgenologist. Most röntgenologists are rather enthusiastic over the results obtained in the treatment of uterine bleeding by means of the x -rays. Thus, Lange² states that if the proper technic is employed, the effect of Coolidge tube radiation upon the ovaries is the most certain of medical phenomena. He reports on 50 consecutive cases of menorrhagia, dysmenorrhea and uterine fibroids which he has treated by the Röntgen rays. In every case a satisfactory result was achieved, an artificial menopause, apparently permanent, occurring in every case in which it was desired, regardless of the age of the patient. He has found it a safe working rule, that if one period is missed, all treatment may be omitted from that date, as it is almost certain that even if there should be an occasional showing, a permanent cessation of menstruation will finally result. In patients past forty years of age, one treatment often suffices (100 X), four being the maximum, while naturally the younger the patient the greater the number of treatments that will be required.

Prevention of Constitutional Symptoms. Since the introduction of the measured massive deep dose in röntgenotherapy, certain more or less unpleasant symptoms have been observed following the exposures. These are chiefly of a systemic nature, and are sometimes quite distressing and even dangerous, especially when the patients are aged, debilitated or cachectic. These symptoms do not appear immediately

¹ Medical Record, 1916, vol. lxxxix, p. 991.

² American Journal of Röntgenology, 1916, vol. iii, p. 72.

after the treatment but develop in from two to twelve hours, and consist of malaise, nausea, lack of appetite, glandular enlargements, and metallic taste in the mouth varying in intensity in different patients and according to the quantity of dosage given. Lange¹ believes that these symptoms are due to an acidosis caused by the disintegration of the acid protein cells of the tissues as a result of the exposure to the Röntgen rays and therefore alkalies are indicated in the treatment of these symptoms. On this basis, he gives 30 grains of sodium bicarbonate every three or four hours for the first forty-eight hours after a treatment supplemented by the copious drinking of alkaline waters, and, as a result, there has been a definite amelioration of these annoying symptoms.

Operative Treatment of Fibroids. A review of medical literature, in order to be of real value, must of necessity give the pro and con of every question considered. I have dwelt at length upon the treatment of uterine fibroids by means of radium and the x-rays but thus far mention has hardly been made of the orthodox method of treatment, namely, the surgical extirpation of the growth. One of the main arguments of the radiation enthusiasts against surgical treatment is that the mortality following surgical treatment is bound to be higher than that after radiation. This may be true, but, on the other hand, the technic of surgical operation in these cases has been refined to such a point that the mortality subsequent to operation may be practically disregarded, speaking, of course, of the work done by experts in this line. For example, Deaver² reports a series of 750 operative cases, covering a period of 11 years in which there were only 13 deaths, or a mortality of 1.73 per cent., there being no fatal outcome in the last 100 cases in this series. He states that the results of radium would need to be marvelous if it is to vie as a symptomatic treatment with an ideal curative treatment that shows so small a mortality. Furthermore, it should be noted that a large number of these cases were such as could scarcely be undertaken with any hope of success by even the extreme radium enthusiast. Many possessed huge fibroids which had contracted extensive adhesions, some were parasitic on the omentum or intestines; numerous degenerative changes were present. Of the last 513 cases, 111 showed hyaline degeneration; in 26 cases it was either hemorrhagic, necrotic or calcareous, or a combination of these. Carcinoma was associated in 8 cases, tuberculosis was noted in 1 case; pyosalpinx was found 14 times, in 2 cases tuberculous salpingitis was present. Ovarian cysts were found in 48 cases and intraligamentary cysts in 7 cases; of the ovarian cysts, 8 were dermoids, 2 showed intracystic papillomas and in 2 early malignant changes were found; sarcoma of the ovary was observed once. It will be noted that the percentage of associated malignant disease alone was larger than the percentage of mortality. Deaver believes that he is justified in asserting that both the Röntgen rays and radium have failed to demonstrate specific power over fibroid growths and therefore must be placed in the

¹ American Journal of Röntgenology, 1916, vol. iii, p. 356.

² Journal of American Medical Association, 1916, vol. lxvii, p. 1216.

category of symptomatic forms of treatment which accomplish good results in occasional cases, like the use of corrosive plaster in epithelioma, but when used as a measure of general applicability, will do great harm in causing delay of the radical treatment and exciting false hopes of non-operative cure that may deprive many of proper treatment. In all cases the treatment is expensive and often tedious, and it does not safeguard against future trouble. Bearing in mind also the curious relationship between various radiations and malignant disease, it is impossible to dismiss subsequent hazard of carcinoma or sarcoma in the pelvic tissues. Deaver therefore concludes that operation, by which the patient is rid completely and finally of the growth, or growths, and associated pathology, remains the ideal treatment.

A British Report. The experience of Bland-Sutton in this line of work is beyond question since he has removed the uterus for fibroids in over 2000 women. His latest report¹ describes the various complications and varieties of growth that he has encountered in this large series, and also the statement that there has been no mortality among the last 200 cases operated upon. He quite tersely states the following aphorisms which he has formulated as a result of his large clinical experience.

Two things disquieting in diagnosis:

1. To distinguish between solid ovarian tumors and large subserous fibroids.

2. And between tubal swellings and fibroids.

Three foolish things:

3. To give opinions on pelvic swellings without making a vaginal examination;

4. Or on hypogastric swellings without passing a catheter;

5. To remove fibroids without examining the woman's urine for sugar until she is comatose two or three days after operation.

Four useful things to know:

6. When a barren woman between thirty-five and forty-five years has retention of urine, it is almost certain that she has a fibroid in her womb;

7. A fibroid that suddenly becomes painful during pregnancy is probably in a state of red degeneration. The clinical signs simulate tubal pregnancy, axial rotation of an ovarian tumor and acute infection of the appendix;

8. Errors in the differential diagnosis of fibroids and pregnancy are usually made before the fetal heart is audible;

9. A cancerous mass in the pelvic colon, in contact with the uterus imitates the signs of a subserous fibroid.

Four things that are wise:

10. When in doubt whether a big uterus in a young woman contains a child or a fibroid, wait a month and reëxamine the patient;

11. To remember that ovarian tumors give much trouble to pregnant and lying-in women, but fibroids are more deadly because they are liable to become septic;

¹ British Medical Journal, July 29, 1916, p. 133.

12. After the removal of a fibroid in the procreative period of life, a woman is more liable to grow more fibroids than to conceive successfully;

13. To remember that uterine bleeding after the menopause, in a barren woman with a fibroid, often signifies the existence of cancer within the uterus.

New Method of Performing Hysterectomy. Before leaving the subject of uterine fibroids, it might be well to call attention to a new modification in the technic of performing a subtotal hysterectomy as devised by Carvallo¹ of the University of Lima, Peru. In addition to simplicity, it has the advantage of absence of bleeding, since compression of the bloodvessels is made without any difficulty at the very beginning of the operation.

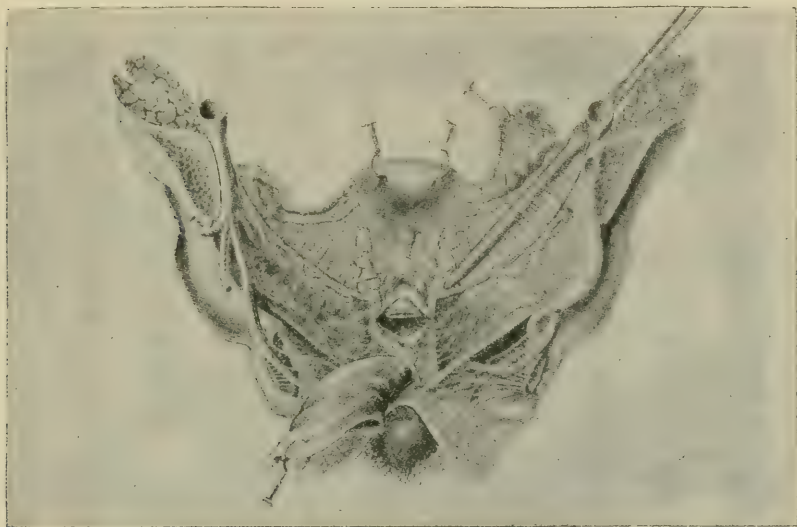


FIG. 74.—Application of clamp to the broad ligament.

Technic. After making the usual median laparotomy incision, the fundus of the uterus is grasped with a tenaculum and pulled as high as possible and then flexed forward toward the pubis as if it were to be delivered from the abdomen. The assistant now cares for this while the surgeon examines the uterus and adnexa and pushes down the bladder so as to bring it and the ureters close to the pubis. The broad ligament is stretched out and brought within reach. The thumb and index finger of the left hand grasp the broad ligament just outside the adnexa and seek the cervix through the walls of the vagina, ascending slowly from there to the point where the beating of the uterine vessels can be felt, which is the point where the artery crosses the ureter. The right hand now seizes a strong long forceps with flexible points and compresses the area covered by the thumb and index finger of the left hand.

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 614.

The whole breadth of the broad ligament is thus compressed above the points of the forceps which touch the borders of the cervix. The forceps are slowly, but tightly, locked to completely close the three arteries of the uterus and to fix the two layers of the broad ligament in a constant position throughout the operation. This process is repeated on the opposite broad ligament. The assistant then holds the uterus, while the surgeon cuts the two sections of the broad ligament with a pair of long, strong, curved scissors following the edges of the closed forceps, thus removing the uterus and adnexa. If the ends of the uterine arteries are visible, they are now ligated. If, however, the cut has been made too close to the forceps, each of the vessels is ligated by a U-shaped ligature to the surface of the cut below the forceps. The ligation of the funicular and ovarian arteries is made in

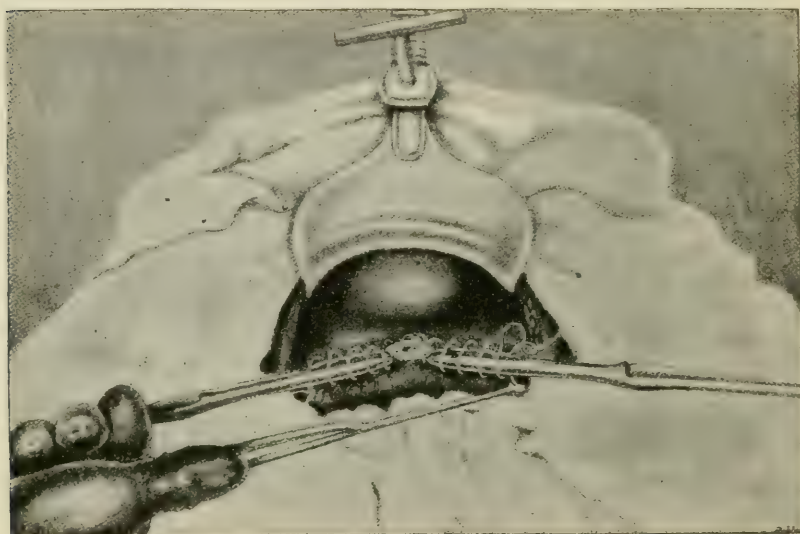


FIG. 75.—Method of peritonization and ligation.

connection with performing the peritonization. A long No. 2 catgut and pedicle needle are now passed below the forceps around the stem of the infundibulopelvic ligament and the ovarian vessels ligated. Stitches are now made in such a way that the spirals formed by the catgut enclose both the borders of the remaining part of the broad ligament and the forceps compressing this part. One of these spirals encloses the artery of the round ligament and suffices for the ligature of this vessel. From here the stitches are continued until the cervix is reached. The forceps compressing the sewed part of the broad ligament is now removed, and the catgut pulled just as if it were a curtain string. The ligation and peritonization of the cervix and of the other broad ligament is accomplished in the same way. When the second ovarian artery is reached, a small forceps is placed below the larger one compressing the ligament. The larger forceps is removed and the catgut

tightened, then the ovarian artery is ligated and the small forceps is removed, completing the operation. Carvallo believes that by the use of this method of suturing, a solid stem is formed by the peritoneal wall which is capable of preventing prolapse of the uterine stump.

Retroversion of the Uterus. One of the most difficult features of writing a review of this kind each year is the long and tedious process of sifting the voluminous literature on uterine retroversion. During the past year, new operations for the correction of this displacement have been described *ad infinitum*, some of the methods actually being new while others are merely new "wrinkles" applied to old and time-worn procedures. To the reader, who may be interested in this subject, I would mention that Chalfant¹ has recently extensively reviewed all available literature, quoting more than one hundred surgeons and consuming ten pages in hardly more than mentioning the different types of operation that have been proposed. The subject has also been reviewed by Crossen² who calls attention to the foolish way in which each originator of an operation believes that his own is the best and is the type that should be used in all cases, even going so far as to try to show by statistics that their own operation gives 90 per cent. of cures. This is all nonsense, and makes no impression on the really serious thinker as there is no one operation which is applicable to all cases. Most of the symptoms in retrodisplacement cases, according to Crossen, are due to complicating conditions which must be recognized and treated if the symptoms are to be relieved. The complications determine, to a very large extent, the method of treatment to be employed for the relief of the displacement. Normally, the uterus is maintained in place by a combination of structures. In any scheme of restoration, either this combination support must be restored or some one, two or three supporting structures must be strengthened sufficiently to supply the support of missing factors as well as their own quota. When the adnexa are intact and the tissues are freely movable, good results can be secured from the transperitoneal transplantation of the round ligaments into the abdominal wall, subperitoneal transplantation of the round ligaments into the abdominal wall, posterior implantation of the round ligaments, anterior plication of the broad ligaments, posterior plication of the broad ligaments, lateral folding of the round ligaments or ventral suturing of the round ligaments. When the tube, or ovary and tube on one side have been removed, Crossen believes that the best result is to be obtained by posterior folding of the round ligament over the pedicle. When the ovary alone has been removed or varicose veins in the broad ligament have been excised, the case is suitable for the operative methods recommended for the first class of cases except drawing the round ligaments backward through the broad ligaments or posterior plication of the broad ligaments, as these operations are likely to embarrass the circulation. When the pelvic tissues are infiltrated and stiffened, the case is not suitable for drawing the round ligaments into the abdominal wall nor backward through the broad ligaments. If the

¹ International Abst. Surgery, November, 1916.

² Journal of Missouri State Medical Association, 1916, vol. xiii, p. 203.

cervix is too far forward, the uterosacral ligaments should be shortened in addition to the work for holding the fundus forward and it is also important in such a case to make a particularly strong repair of the pelvic floor. When pregnancy is no longer possible, either because both ovaries have been removed or because the patient has passed the menopause, Crossen believes that the uterus should be removed if it presents any abnormality that is likely to give trouble.

SYMPTOMATOLOGY. As a result of an analysis of a series of 300 gynecological cases, 109 of which had retroversion of the uterus, Jacoby¹ believes that it is clearly demonstrated that backache or a bearing-down sensation is never associated with retroversion *per se*. Of these cases, 45 were uncomplicated by any other pelvic disorder, 30 were associated with a posterior parametritis, 17 with diseased adnexa, 9 with both posterior parametritis and a descensus uteri, and 8 with a descensus uteri alone. In some text-books on gynecology, backache is mentioned as the most prominent symptom of retroversion. However, in this series of 109 cases, backache was not complained of by a single one of the 45 cases of uncomplicated retroversion. On the other hand, all of the 30 patients with retroversion associated with a posterior parametritis did complain of backache. In all 9 cases associated with posterior parametritis and descensus uteri, there was a complaint of backache and bearing-down sensation. In the 8 cases associated with descensus, none complained of backache, but all complained of pain in one or both sides of the lower part of the abdomen. It is evident, therefore, that retroversion, unless associated with a posterior parametritis, does not give rise to backache, while backache is a constant complaint of patients suffering with posterior parametritis. In 50 cases leucorrhea was present; of this number, 10 were cases of uncomplicated retroversion while in the other 40 complications were present. Irregular or profuse menstruation occurred in 26 cases, 9 of these being simple cases and 17 being complicated.

NEW OPERATIONS FOR RETROVERSION. The rather modest name of "shirring the round ligaments" has been given by Long² to his new method for correction of the retroverted uterus. Having opened the abdomen and exposed the parts, the round ligament is seized about midway with forceps. The exact point at which to catch the ligament is determined by estimating the amount of slack to be taken out of the ligament. On making traction upon the distal portion of the ligament with forceps, from one-half to one inch of the ligament will be pulled out of the inguinal canal. While tension is being continued, a round needle, armed with linen or silk, is thrust through the ligament close to the pelvic brim, just at its exit from the internal inguinal ring (*a*). The needle is again put through the ligament about one-quarter inch farther toward the fundus. This is repeated again and again until sufficient length of the ligament has been sutured to insure the proper degree of shortening. The last puncture of the needle is usually made through that portion of the ligament which is traumatized

¹ Medical Record, 1916, vol. lxxxix, p. 281.

² Annals of Surgery, 1916, vol. lxi, p. 690.

by the bite of the forceps. By lightly pulling upon the ends of the suture, the ligament begins to "shirr," to use dressmaker's parlance, which necessarily shortens it. When the knot is tied, it hugs closely the internal ring. When this is finished, a small peritoneal meso-ligament is formed, which is utilized to cover the shirred portion of the ligament, by tacking it to the upper portion of the round ligament by means of the last suture. Long has employed this operation for over three years with entire satisfaction.

Kellogg¹ describes the method which he has used in over 1600 cases during the last twenty-seven years. A separate incision is required for each ligament and it is important that the incision should be made at

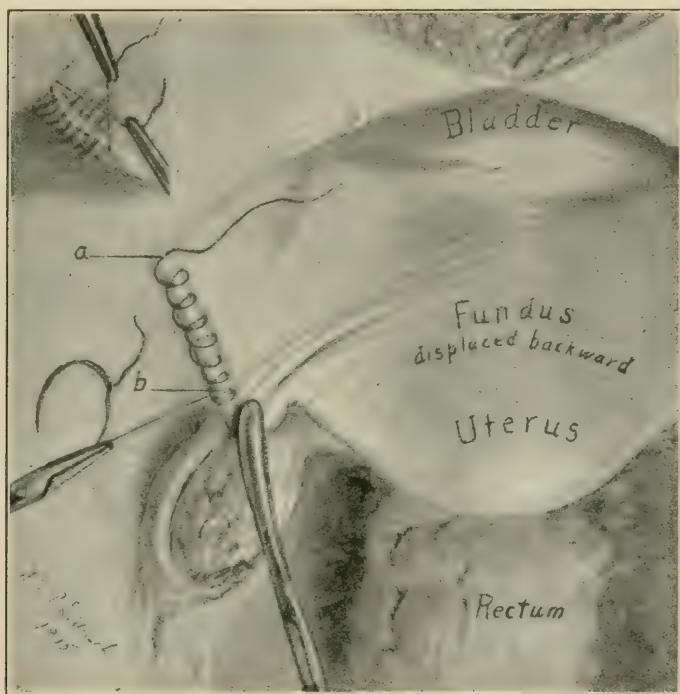


FIG. 76.—Method of placing suture.

the right point. To do this, find the middle of Poupart's ligament, place the finger upon this point, then start the incision at a point about 1 cm. nearer to the pubic spine and 2 cm. internal to Poupart's ligament. The incision should extend only through the skin and should not include the subcutaneous fascia or fat, and need not be more than 3 cm. long. The remaining dissection is made entirely with blunt hooks and is continued until Poupart's ligament is brought plainly into view. The blunt hooks are then pushed through the roof of the inguinal canal at a point about one-third of the distance from the pubic spine to the

¹ Medical Record, 1916, vol. lxxxix, p. 719.

anterior superior spine of the ilium. One hook is turned outward toward the ligament and is dipped down until the round ligament is caught. The ligament must be sought in exactly the right spot since if the hook is introduced even 1 cm. away from the proper point, the ligament will be found only with much difficulty. It is most easily secured at a point about 1 cm. below the internal ring, and of course will not be found above the ring; if the ligament is sought too far inward, only muscle will be found. By persevering effort, the ligament may sometimes be found when the incision is not rightly placed, but only after the internal oblique muscle has been much lacerated and this should be avoided as it delays healing of the wound, and is likely to be

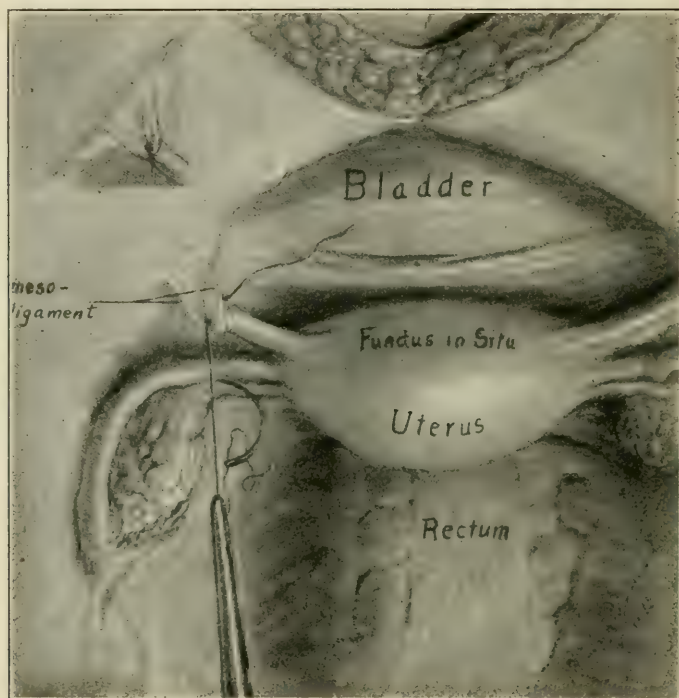


FIG. 77.—Operation completed.

a cause of discomfort to the patient later. When the ligament is found, the adherent tissues are gently separated and the ligament is drawn out of the internal ring as far as possible. The next step is to attach the ligament at its thickest part to the aponeurosis of the external oblique at the upper angle of the puncture by means of chromic catgut. To obviate the danger of a hernia finding its way out alongside of the round ligament, the loop of the ligament is drawn back into the canal and pulled up through the aponeurosis at a point 5 or 6 cm. higher up and 2 or 3 cm. toward the median line. To accomplish this, an aneurysm needle is passed into the canal along the inner side of the ligament and made to emerge at a point 5 or 6 cm. higher up and 2 or 3 cm. toward

the median line. A silk ligature is then threaded into the aneurysm needle and the needle is withdrawn. About an inch of the ligament is passed through the silk loop and then the ligament is drawn back into the canal and up through the aponeurosis. The end of the loop of the ligament is again drawn under the aponeurosis of the external oblique and made to emerge at the original opening through which it was first pulled out. The opening in the roof of the inguinal canal is then closed, the loop of round ligament being sutured to its under side. The superficial fascia and skin are sutured in the usual manner. Within the last fifteen years, the proportion of failures of this operation is estimated

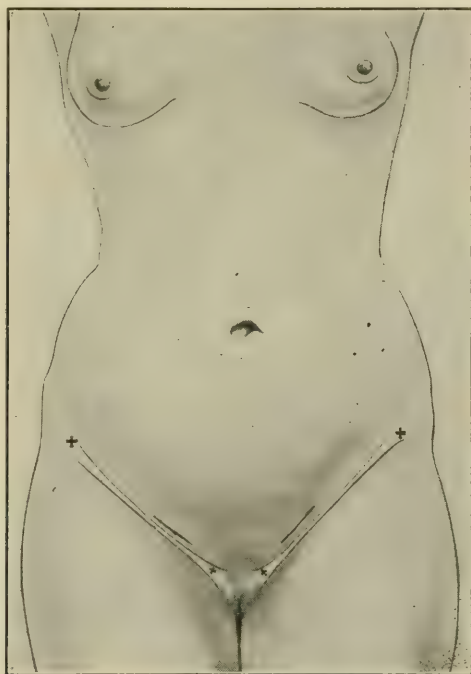


FIG. 78

at less than 1 per cent. by Kellogg. The contra-indications to the operation are procidentia, the presence of uterine or adnexal adhesions and symptomless retroversion in middle-aged women.

Neel¹ has had most satisfactory results from his modification of an operation originally suggested by Kelly. Through a midline incision the pelvic viscera are exposed in the usual manner and the fundus brought forward to its normal position. The fascia of the rectus muscle is then dissected free just above the symphysis pubis to allow the permanent silk suture to be anchored to the under surface about 4 cm. from the midline incision. This suture is then carried through the underlying rectus muscle and peritoneum immediately above the

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 233.

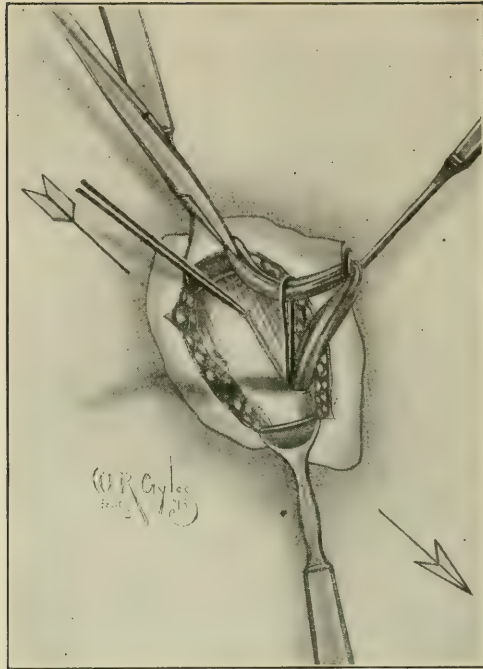


FIG. 79

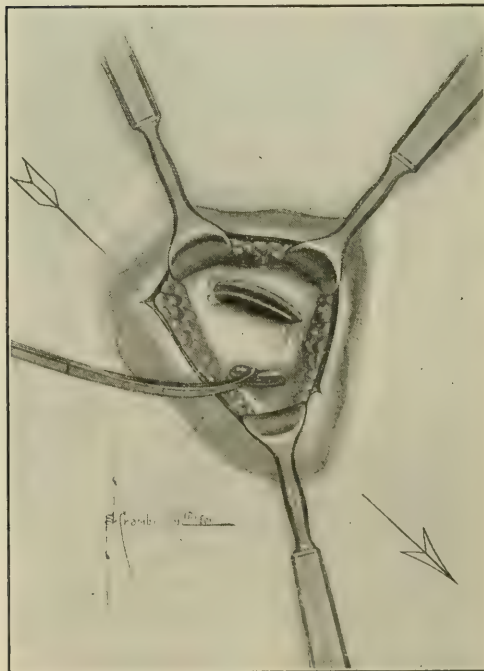


FIG. 80

vesical reflection on the abdominal wall; the parietal peritoneum is next taken up at about 1-centimeter intervals down to the internal inguinal ring; the suture is then carried along the course of the round ligament to a point within 1 or 2 cm. of the uterine cornu where the ligament is pierced and the suture is brought out through the abdominal wall at a point near where it entered. The same procedure is followed on the opposite side. Both sutures are then drawn tightly and tied, the knots being buried under the rectus fascia. The results obtained by the introduction of these sutures are: (a) The broad and round ligaments are utilized and given a broad attachment to the abdominal wall. (b) The lateral openings are closed by the purse-string action of the suture and thus prevent the incarceration of the bowel. (c) The fundus is loosely poised in the pelvis with the slightest possible mutilation. In order to bring the cervix into proper position, a running purse-string suture of silk is taken in the cervix where it is joined by the uterosacral ligament on either side and carried along the course of the ligament to the pelvic brim. In placing these sutures, the ureter, which usually lies outside the ligament, must be avoided. When these sutures are tied, the cervix is drawn high in the vaginal vault and a shelf is made on either side for the support of the tube and ovary. The advantages claimed for this operation by Neel are that there is no mutilation of pelvic structures, or raw surfaces left for the formation of adhesions, and it offers no hindrance to future gestation since the normal supports of the uterus are utilized in such a manner as not to interfere with their evolution and involution.

In the operation described by Allen,¹ the abdomen is opened in the usual manner. Holding the edge of the rectus sheath taut, a strip of this about one-quarter inch wide is cut from the margin as long as the incision, the upper end of the strip being severed while the lower end is left attached. The uterus is next brought up high enough to make the posterior surface easy of access, as low as the origin of the round ligaments, and a shallow cut is made across this surface from the origin of one round ligament to the same point on the other side. In making this cut, the knife is held at an angle to the uterus of forty-five degrees, so that later on the incision may be completely closed. The uterus is then drawn to one side and held firmly while the next important step is taken. An eight-inch hemostat, with jaws curved to a right angle with the blade, is thrust from behind forward through the broad ligament on a level with the end of the incision on the posterior surface of the uterus and made to traverse the following structures in the order named; the parietal peritoneum and posterior rectus sheath, the fibers of the rectus muscle. Thence it is made to emerge at the edge of the wound without having pierced the anterior sheath of the rectus and at or near the level of the lower end of the incision in this latter structure. The jaws of the hemostat are then opened and the free end of the strip of the rectus sheath previously cut, is grasped, and the hemostat withdrawn until the jaws appear at the

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 618.

point where they entered. After the same procedure is performed on the opposite side, the ends of the strips are cut to the proper length if too long, and they are then sutured carefully to the bottom of the groove with twenty-day gut. The cut in the uterus is then sutured

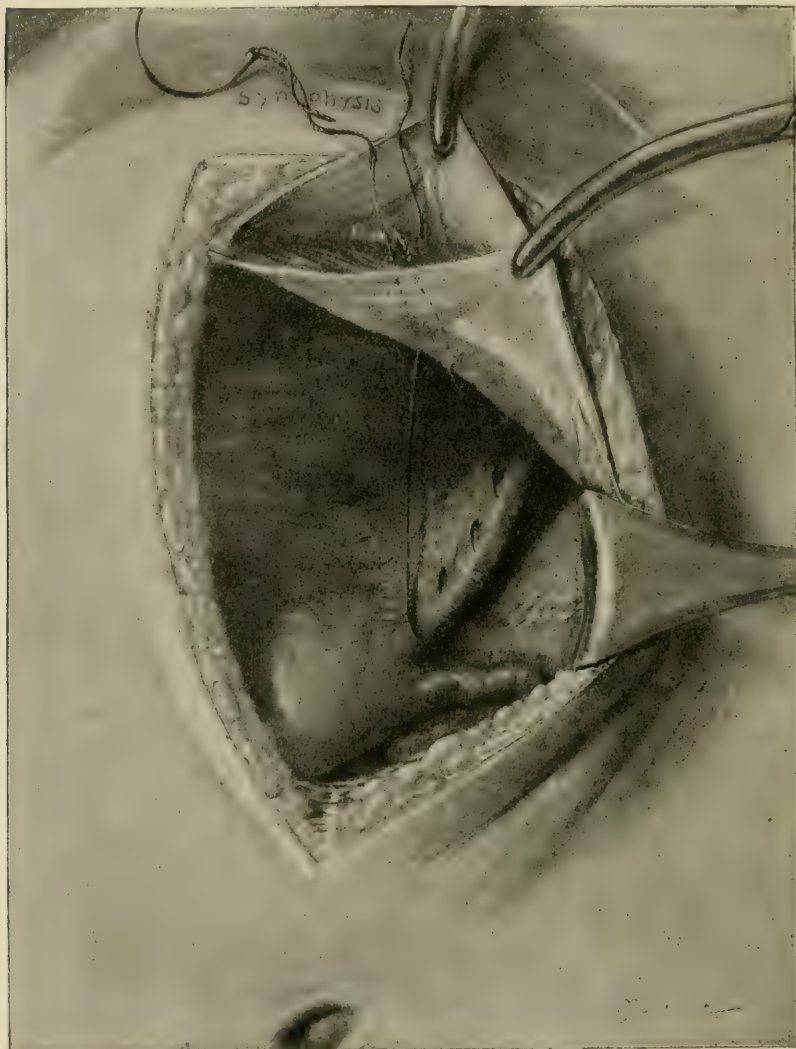


FIG. 81

with fine gut and one or two stitches are made to include the strip, the round ligament and the broad ligament on either side. It is, of course, obvious that this method can only be used in patients past the menopause, or in others where the tubes have been tied or other means of sterilization employed.

Bissell¹ has recently described his latest technic in dealing with these cases. The round ligament is grasped near its center with two bullet hooks which should be 2 cm. or more apart from each other. Gentle traction is made and the tense portion of the ligament between the forceps is split through its middle longitudinally, the point of the knife

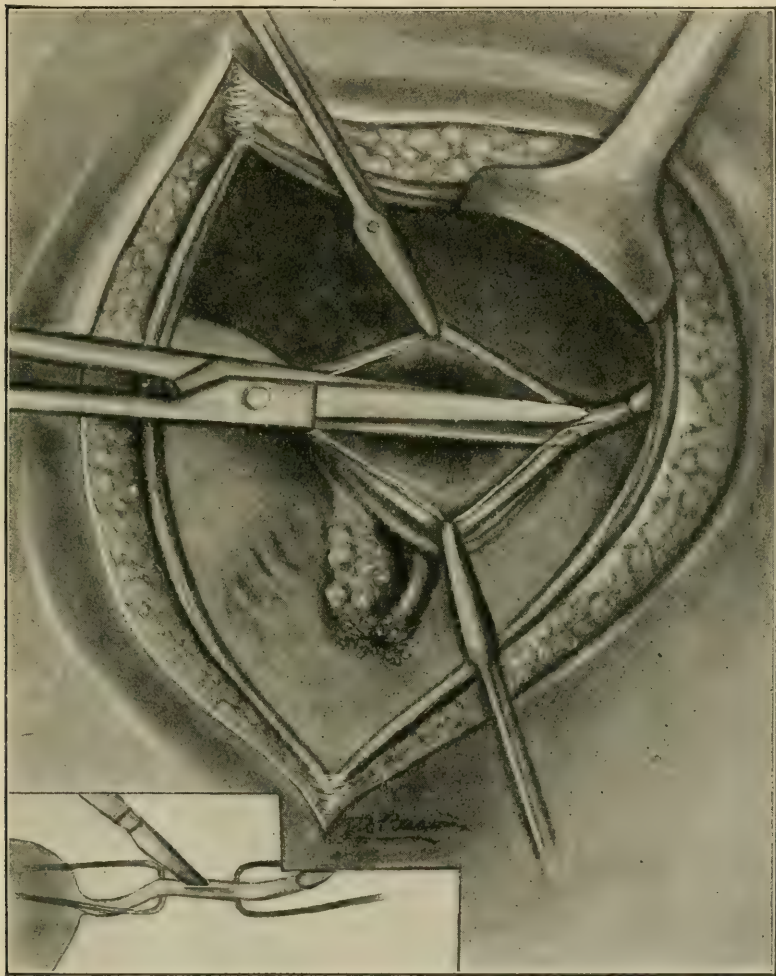


FIG. 82

passing down between the surfaces of the broad ligament. Each split portion of the round ligament is now grasped with a Sims-Tait forceps and the sponge forceps or hooks released. The straight Mayo scissors is next passed through the slit in the round ligament, forced down between the layers of the broad ligament and opened several times so

¹ American Journal of Obstetrics, 1916, vol. lxxiv, p. 1.

as to separate the surfaces. With the same scissors, the longitudinal incision of the round ligament is continued on the distal side to within close proximity of the infundibuliform process of the ligament and on the proximal side to its uterine insertion. The anterior split portion of the round ligament is now severed about 1.5 cms. from the infundibuliform process and cut away from its broad ligament attachment.

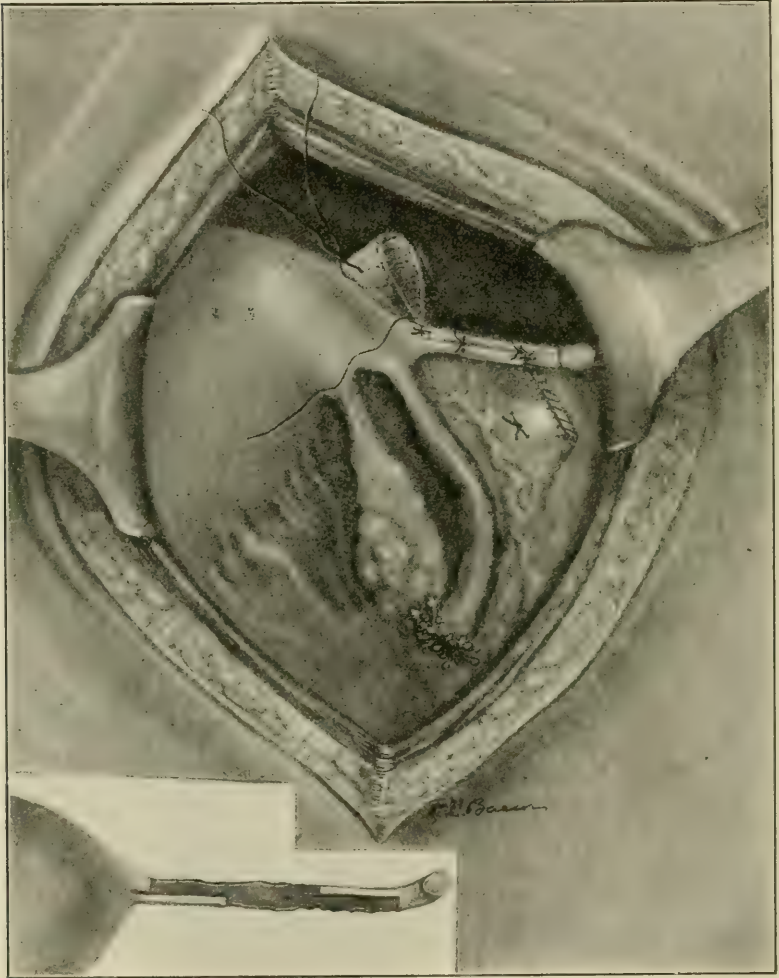


FIG. 83

The posterior split portion is severed about 1.5 cms. from its uterine insertion and cut away from its broad ligament attachment. The cut end of each remaining portion of the round ligament is sutured to its corresponding cut end with silk or linen and the apposing lateral surfaces of the split portions are held together by plain catgut penetrating them at their middle. Thus reconstructed, the round ligament is

about 2.5 cms. in length and larger in diameter than it was previously. The posterior surface of the broad ligament is now grasped at its middle, folded upon itself and penetrated at its base with a mattress suture of No. 1 chromic catgut, care being taken not to encroach upon the Fallopian tube in passing the suture. When the mattress suture is tied, the posterior surface of the broad ligament is narrowed, and the cut edge of the fold is united with a continuous catgut suture. The anterior surface of the broad ligament is treated in the same way, care being taken to avoid the uterine artery. A *temporary* ventrosuspension of the uterus is performed when the uterus is large and heavy in order to relieve the strain upon the reconstructed ligaments until they are firmly united.



FIG. 84

CONGENITAL *Versus* ACQUIRED RETROVERSION. A very interesting contribution, at least from the academic stand-point, perhaps from the practical side also, has been made by Sturm¹ who believes that he has found a simple method of differentiating congenital from acquired retroversion. He claims that with normal spinal contours, the axes of the abdominal and pelvic cavities form almost a right angle, while in the "gorilla type" of stature, there is a marked flattening of the sacro-vertebral angle resulting in an approximation of these axes toward the vertical, so that the thrust of intra-abdominal pressure is expended in a more direct line on the pelvic viscera. This flattening of the sacro-vertebral angle, is regularly evidenced by a corresponding obliteration of the normal lumbar curve, and the measure of its resultant approxi-

¹ American Journal of Obstetrics, 1916, vol. lxxiv, p. 386.

mation to the vertical constitutes a pathognomonic index in differentiating congenital from acquired retrodisplacements of the uterus according to this theory. To obtain this measure, the patient, with back exposed, assumes her natural standing position, while the edge of an ordinary 18-inch desk ruler, held vertically in contact with the most prominent spinous processes of the dorsal and sacral convexities, spans the intervening lumbar hollow. The distance in millimeters, from the deepest point of this hollow to the edge of the ruler presents our index. The spinous processes of the dorsal and sacral convexities are invariably and distinctly palpable under all degrees of adiposity and statural deviations, while the extreme simplicity of the method and means enables anyone to substantiate the uniform accuracy of the index and elicit the significance and indications of its clinical bearings. In an extensive series of observations, Sturmdorf found that the index ranged from 12 to 45 mm.; an index of 30 mm. marks the extreme minimum compatible with normal anteversion of the uterus, while an index of 25 mm., or less, is almost positive evidence of a congenital retroversion. In fact, Sturmdorf is so sure of these facts that he states that the existence of a congenital retroversion may be positively predicated in nearly every case prior to its bimanual verification, regardless of multiparity and the other complicating factors, when the index is found to be less than 25 mm. He also emphasizes that patients with uncomplicated congenital retroversion suffer through a constant attitudinal strain in maintaining their unstable skeletal poise within the lines of gravity, the congenital displacement, in contrast to the acquired form, being an accompaniment, and not a cause, of the suffering. These cases must be treated on purely mechanical and orthopedic principles. During and complementary to the general orthopedic measures, a properly molded pessary inserted—not with the object of anteverting the uterus, but to act as an artificial ledge at the deficient sacral promontory in the deflection of intra-abdominal pressure—will afford much relief during the necessarily prolonged period of mechanical treatment.

Prolapse of the Uterus. ETIOLOGY. In considering the etiology of uterine prolapse, Fitzgibbon,¹ of the Royal City of Dublin Hospital, states that prolapse and cystocele are due to damage of the pelvic fascia in the region of the lateral fornices and in front of the cervix, but prolapse must be clearly differentiated from cystocele since they may exist separately or combined. Laceration of the perineum and levator ani muscles has no part in the production of prolapse, but it allows an increase of cystocele when there is a primary defect. Since prolapse and cystocele are analogous to abdominal hernias through scars, due to defective union of the fascia, the cure of the condition can be effected by reuniting the fascial diaphragm across the pelvis, which may be done without interfering with the function of the uterus or dislocating the bladder. The condition can be treated in exactly the same manner before and after the menopause, since atrophy of the uterus has no influence upon its support. Amputation of the cervix,

¹ Surgery, *Gynecology and Obstetrics*, 1916, vol. xxiii, p. 7.

other than the removal of an hypertrophied lacerated vaginal portion, is considered unnecessary.

OPERATIVE RESULTS. Bjoerkenheim¹ reports the ultimate outcome in 205 of the 300 cases in which operative treatment was applied for genital prolapse at the Helsingfors clinic, with an interval since of from one to twelve years. The prolapse returned in 24.4 per cent. Relapse occurred in 46.9 per cent. of the 32 cases in which the Hegar, or Lawson Tait vaginal plastic method was used. There was relapse in 26.3 per cent. of the 80 cases in which ventrofixation was done by the Czerny-Terrier method. In 15 cases the women passed through a pregnancy later without disturbance after a ventrofixation plus colpoperineorrhaphy according to Hegar, but 6 of these women had the prolapse return later. The Schauta-Wertheim technic was applied in 10 cases with relapse in 11.1 per cent. The round ligaments were shortened in 4 cases and the results have been permanently good. Vaginal hysterectomy was done in 92 cases, and the ultimate outcome is known in 68 cases, with relapse in 13.2 per cent. Bjoerkenheim ascribes the failures to lack of adequate care in the vaginal plastic operations. With anterior colporrhaphy, for instance, the bladder should be entirely detached and the cystocele reduced by suturing in a fold of the bladder; with colpoperineorrhaphy, on the other hand, a high and firm raphe should be made, as well as a broad and strong rectovaginal septum, and the levator fascia should be sutured.

PREGNANCY AFTER WERTHEIM'S OPERATION. Weibel² reports 2 cases from his clinic and cites 3 others from the literature in which conception occurred after the performance of Wertheim's interposition operation for prolapse. In 2 of the total 5 cases, the pregnancy progressed normally, until near term and Cæsarian section was successfully done. In the other cases, perforation of the fetal skull became necessary or abortion had to be induced. When Wertheim proposed this method of treating genital prolapse by drawing the fundus of the uterus over forward and suturing it to the vagina, he had only women past the child-bearing age in mind, or those that had been artificially sterilized, and the present cases would not have occurred if the operators had not disregarded these restrictions.

Troublesome, Useless Uterus. Under the title "troublesome, useless uterus," Gallant³ includes uteri which are *troublesome* because they are the cause of intractable suffering and *useless* because they are either absolutely, relatively or practically incapable of performing the one sole function of the uterus, namely, reproduction. He does not refer to the cases in which the pathology clearly indicates the removal of the organ, but to cases in which the presence of the uterus is a menace to the success of other operative procedures, especially seen in the treatment of cystocele. The removal of such a "troublesome, useless uterus" is not only justifiable but the most rational procedure in senile women

¹ Finska Läkarsällskapetets Handlingar, 1916, vol. lvii, No. 8, by Journal of American Medical Association.

² Arch. f. Gyn., 1916, vol. cv, No. 1, by Journal of American Medical Association.

³ New York Medical Journal, 1916, vol. ciii, p. 485.

and denudation and complete closure of the vaginal canal is the one sure and permanent means of curing hernia vaginæ. In well-nourished women who have ceased to menstruate, or who have passed, or are approaching, the approximate age when the menses should cease, hysterectomy and partial colectomy will prove most beneficial and still provide for marital relations. In a menstruating woman under thirty-five years, after every means to conserve her child-bearing function has been exhausted, when the conditions cause a life of semi-invalidism, when they prevent her from working and earning a living, when they interfere seriously with her duties to her husband and children, then, as a last resort, Gallant believes that the uterus should be removed as the safest, surest and most satisfactory operation.

Anterior Transperitoneal Hysterotomy. Deaver¹ is sure that uterine disease will be better treated when many of the present blind methods of diagnosis and treatment have given way to direct inspection and treatment under the guidance of the eye, and for this reason he is advocating hysterotomy as a means of diagnosis in obscure cases more ardently than ever before. He has been performing this operation for over five years without mortality and insists that the operation is relatively free from risk if rigid asepsis is enforced, the uterus carefully delivered and walled off from the general peritoneal cavity, the uterine wall carefully closed and the operation performed early before manipulation from below has sapped the patient's strength and introduced infection. This operation was performed upon 21 cases because of bleeding which aroused suspicion of malignant disease of the interior of the uterus. Ten of these cases showed retained products of conception; naturally, he would like to avoid hysterotomy in these cases, but the circumstances were such that pregnancy did not seem a probable explanation of the symptoms. Among the other cases in the series, 1 showed an early chorio-epithelioma, another showed an early carcinoma of the left cornu, while in 3 other cases a uterine polyp was found. The majority of these cases had been curetted one or more times without relief prior to the operation. Deaver does not advocate hysterotomy when one curettage has afforded some relief, but he believes that the inadequacy of the curette is demonstrated on opening the uterus after its use, and the histories of many patients are the histories of many such scrapings with no relief. Besides bleeding, there are many other conditions which Deaver considers to be positive indications for hysterotomy, for example, the type of myoma which causes symmetrical enlargement of the uterine wall since in many cases it is impossible to exclude pregnancy, even when the operator has the uterus in his hand. Deaver assures us that there is no danger in future pregnancies as a result of this operation "if you cut well and sew well, using absorbable sutures and putting the sutures down to, but not through, the endometrium."

Operation for Double Uterus and Vagina. Rockey² has devised a new operation for the bloodless correction of the deformity incident to a

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 424.

² Annals of Surgery, 1916, vol. lxiii, p. 615.

double uterus and vagina. In the case which he cites and on which he practised his method, the vaginal septum was divided between two broad ligament clamps and then each cervix was dilated and one blade of a full-length curved clamp forceps was introduced into each uterus. The forceps was then firmly locked, compressing the septum in the uterus. The handle of the forceps was supported by a folded strip of gauze placed under it in the vagina and over the perineum, to avoid pressure injury by its own weight. All three forceps were allowed to remain *in situ* for thirty-six hours and were then removed. The compressed septum soon sloughed out and healed completely, leaving a single uterus and vagina that were normal in appearance. The possible existence of a bicornute uterus with a wide, low divergence of the bodies should be predetermined, as in such a case it might be advisable, after introducing the separate blades of the long curved clamp into the cavities, to raise the table into the Trendelenburg position and close the clamp very slowly to avoid any possible injury by catching the intestine between the approximated uterine bodies.

Sterilization by Cautery Stricture. In cases where sterilization of a female is indicated, Dickinson¹ has elaborated a technic which he claims is simple enough to be performed in the office. The first step in the procedure consists of selecting a proper case, since the patient should have no submucous fibroid or cancer or any other disease which would necessitate a hysterectomy or an abdominal section, because, in such a case, ligation of the tube would be the simplest method. The patient is placed in the Sims position and a Sims speculum is inserted. The anterior lip of the cervix is grasped with a tenaculum and 5 to 10 minims of a 10 per cent. solution of novacaine in adrenalin are injected into the cervical canal under pressure. Ten minutes later, the canal is wiped with tincture of iodine or carbolic acid, and a sterile uterine sound is passed into the canal and up to the fundus. The sound is then rotated until the cornu on one side is found and the distance from the external os to the cornu is noted. The sound is withdrawn and a cautery sound (which is of the same size) is bent to conform in shape with the uterine sound and has its slide pushed up to the point where the external os should reach when the tip is at the cornu. This sound bears on its tip a little spiral or dull point of platinum wire which will become incandescent. The switch is thrown on and the platinum wire heated in order to determine that it is working. The current is turned off and the tip is placed in plain sight against the cervical mucous membrane. The current is again turned on and a count is made of the number of seconds required to burn into the tissues a sufficient distance to bury the platinum wire. This will be the correct time, under ordinary circumstances, for the cornu. The tip is allowed to cool and then the sound is passed into the uterus and finds the cornu as previously determined, the current is turned on for the required number of seconds, care being taken to exert no pressure except that which is necessary to hold the cautery sound in place. The other cornu may be treated

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 203.

at the same time or at a second sitting. The patient should be quiet for a few days after the treatment, although the reaction is no more than that after an ordinary intra-uterine application. There may be a slight bloody discharge a few days later and the next menstrual period may be a trifle uncomfortable.

X-ray Diagnosis in Gynecology. Gottlieb,¹ who is associated with Rubin, the originator of the intra-uterine use of collargol,² has presented a report in which he confirms the earlier report of Rubin. Especially interesting is a röntgenogram of the uterus and tubes into which 3 c.c.

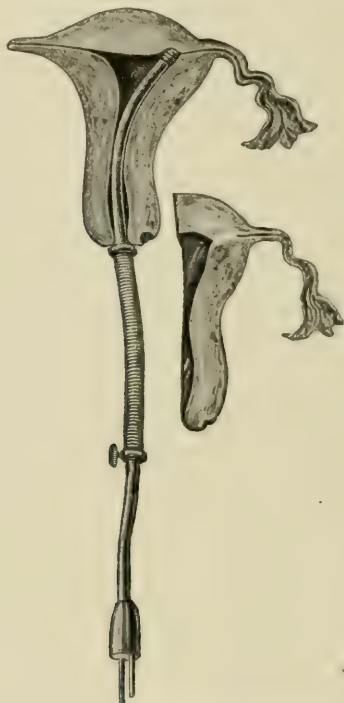


FIG. 85.—Intra-uterine cauterization.

of 10 per cent. collargol have been injected. The plate clearly shows an elongated left tube as it lies stretched around a parovarian cyst and the findings were corroborated by operation.

Tuberculosis of the Cervix. During the past year there have been reports of 2 cases of tuberculosis of the uterine cervix. The first case, reported by Cullen³ occurred in a healthy-looking colored woman, twenty-five years of age, who complained that she had been discharging fecal matter through the vagina for two years. At operation, the uterus was found in retroposition, and the bladder adherent to it above

¹ American Journal of Röntgenology, 1916, vol. iii, p. 257.

² PROGRESSIVE MEDICINE, June, 1916, p. 252.

³ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 261.

the internal os. The sigmoid was adherent to the vesico-uterine reflection just above the level of the internal os, while the right tube and ovary had become twisted over the anterior surface of the uterus. A complete hysterectomy was performed, and the pathological report showed that tuberculosis was present in the cervix. The accompanying photograph shows at each outer portion of the picture normal squamous

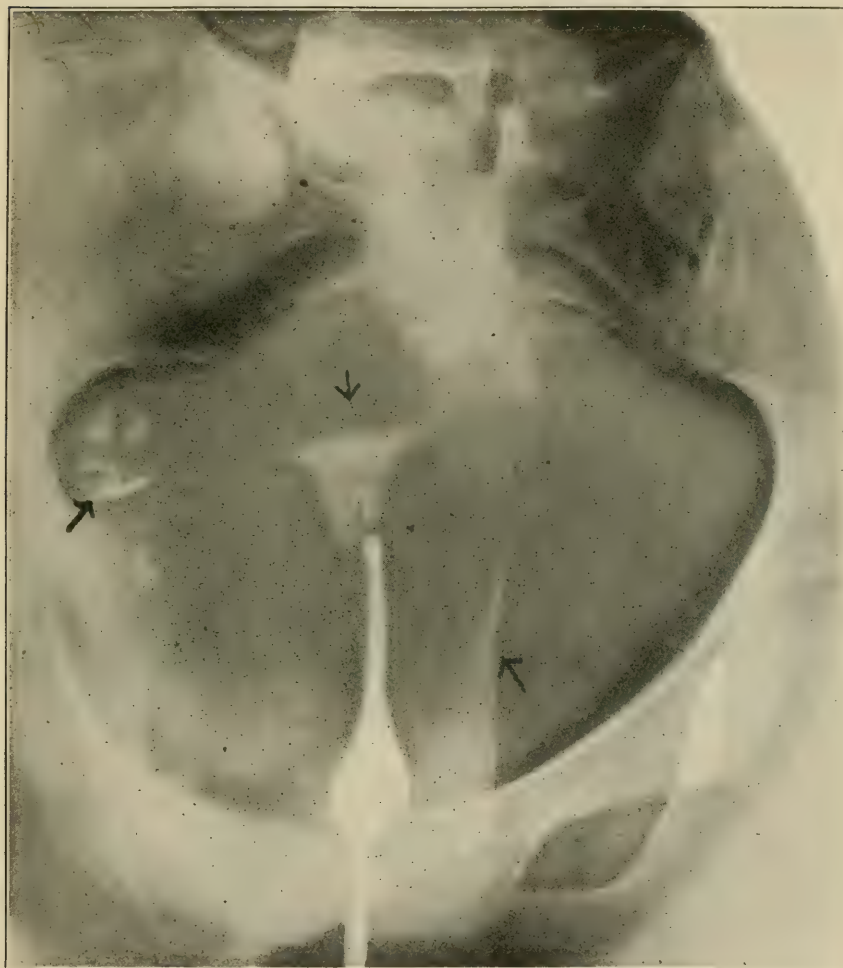


FIG. 86.—Röntgenogram of uterus and tubes.

epithelium with a normal underlying stroma. In the center, the superficial portion of the squamous epithelium is still intact; the underlying layers of epithelium are missing, and a crescentic space is seen filled with blood. Immediately beneath this is a tubercle, occupying partly the epithelial layer and partly the underlying stroma. It is sharply circumscribed, consists of epithelioid cells and contains several

types of giant cells. The stroma on the left shows small round-cell infiltration.

The second case, reported by Metzger¹ was a woman aged thirty-three years, who for four years had had occasional metrorrhagia and a greenish-yellow discharge. She had no pain, but tired very easily and had grown very thin. Upon examination, the cervix showed two small irregular ulcerations, with slightly raised edges, surrounded by sound mucosa, which bled at the slightest touch. Microscopic examination of an excised scrap confirmed the probable tuberculous nature of the lesion although no tubercle bacilli were found. As the woman seemed free from tuberculosis otherwise, her husband was examined and an old apical tuberculous process was evident. The testicles showed no signs of tuberculosis but there had been a urethral discharge about four



FIG. 87.—Tuberculosis of cervix.

years previously which subsided without treatment. This may have been a genital manifestation of his tuberculous infection and have been the source of his wife's genital lesion. She has apparently recovered entirely since the amputation of the cervix and has been gaining weight rapidly ever since the operation.

THE FALLOPIAN TUBES.

Ectopic Pregnancy. An interesting analytical study of 117 cases of ectopic gestation, occurring in the service of Coe in the Bellevue Hospital of New York City, has been reported by Foscett.² The histories

¹ Arch. Mens. d'Obst. et de Gyn., 1916, vol. v, No. 4, by Journal of American Medical Association.

² American Journal of Obstetrics, 1916, vol. lxxiv, p. 232.

of these patients indicated that 77 of the 117 had a definite history of missing one or more menstrual periods, 31 did not miss a menstrual period, 1 had a continuous flow for four and a half months, while in 8 the date of menses was not recorded. Pain was present in all of the cases and was usually described as colicky or cramp-like in character and in most patients there were periods of freedom from pain in which some of them could go about their household duties. Uterine bleeding was present in all of the cases, in many of them being intermittent in character. Vomiting and fainting were present in 62 patients, while collapse was noted in 40 patients. The blood count in these cases was found to be of some value in diagnosis since a low leukocyte and polynuclear count points to an ectopic rather than to a pelvic infection, although it must not be forgotten that the leukocytosis is high in those cases having a severe hemorrhage into the peritoneal cavity. This leukocytosis, however, comes on early and disappears in from twenty-four to forty-eight hours, in this way differing from the secondary anemias where the leukocytosis comes on late and persists. In this series, 49 cases presented an actual rupture of the tube, 64 were tubal abortions, while 4 were unruptured pregnancies with no bleeding from the tube. The location of the gestation sac was described as interstitial in 1, isthmic in 64, and ampullar in 52 cases. In regard to the *treatment*, the author states that curettage is regarded as of little help in the diagnosis and he seldom cures, but rather makes a vaginal puncture in cases of doubtful diagnosis. This was performed in 47 cases, of which 46 showed free blood in the peritoneal cavity; in the 1 case in which blood was not obtained, laparotomy revealed an intraligamentous rupture. Fosskett believes that the safest procedure is to operate promptly when the diagnosis is made whether it is a tubal abortion or a rupture of the tube with severe hemorrhage, as in this way an occasional rupture in the ward, with its severe symptoms, will be avoided, and the best interests of the patient will be served. The mortality of this series was very small, only two patients dying after operation, one from sepsis and the other from hemorrhage. Five of the patients are known to have been pregnant after the operation, one of whom miscarried at five months.

VAGINAL APPLICATION OF CLAMPS. In the treatment of tubal pregnancy by an abdominal section, the patient suffers with shock from the loss of blood, plus that from the peritoneal reflex (due to the peculiar irritant action of the blood upon the peritoneum) and finally has the added shock of the operation with the inevitable exposure of the peritoneum to the air, and to the handling, mopping and possibly washing of peritoneal surfaces in the endeavor to free the abdominal cavity of liquid and clotted blood. Babcock¹ believes that in many cases this superadded shock of an abdominal operation is the important fact in determining the patient's death, and, in order to overcome this factor, he suggests a method which enables one to immediately confirm the diagnosis and check the hemorrhage of tubal pregnancy by a simple,

¹ American Journal of Obstetrics, 1916, vol. lxxiy, p. 276.

rapidly executed operation, with little invasion of the abdominal cavity, with little or no increase of preëxisting shock and with an armamentarium so simple that the operation may be performed on the bed of a country farmhouse.

Technic. The patient is placed in the lithotomy position, the usual vaginal preparation made, a posterior weighted vaginal speculum introduced, the cervix grasped by a tenaculum forceps and pulled downward and forward, the posterior vaginal fold behind the cervix located and the cul-de-sac opened in the median line by thrusting a pair of sharp-pointed scissors through this line toward the posterior uterine wall. The scissors is opened and withdrawn, and the index finger of each hand is introduced through the incision and, by traction, the incision into the posterior cul-de-sac is widely enlarged. The escaping blood is disregarded, two fingers are immediately introduced into the cul-de-sac and swept to each side of the uterus, locating the tubal enlargement. The diseased tube is freed by sweeping the fingers about it, and, when thoroughly isolated, it is pulled down through the vaginal incision. This maneuver may be accomplished by the sense of touch alone. In some instances, to expedite the separation of a very high appendage, Babcock introduces a hand into the vagina; in others, a ring or small sponge forceps has been guided by the finger and used to grasp and pull down the tube. The affected tube with the ovary is pulled well into the vagina and a clamp applied close to the uterus. The tube and ovary distal to the clamp may now be cut away, but care must be taken to leave a sufficiently large pedicle, and to see that the friable tissues do not slip from the grasp of the clamp. When the patient is *in extremis*, nothing but the application of the clamp need be done at this time. A piece of gauze, sufficiently wide to fully occupy the vaginal incision, is introduced into the pelvis high enough to isolate the clamp from the intestinal coils and to prevent the edges of the vaginal incision from coming together. A second strip of gauze is introduced between the vaginal wall and the clamp. As a rule, no large vessels are divided, and the vaginal incision does not require ligature or suture. Irrigation of the abdominal cavity should not be employed, nor should any special effort be made or time wasted in the endeavor to remove blood or clots from the cavity, as the blood will gradually drain away after the patient has returned to bed. The vaginal incision, application of the clamp and insertion of the gauze drainage strips may all be accomplished in from three to ten minutes and the patient is returned to bed with the hemorrhage controlled and with little increase of the preëxisting shock. At the end of 48 hours the clamp is cautiously opened one-half inch, rotated ninety degrees in each direction and removed, while the gauze is removed on the fourth or fifth day and usually does not require replacement. The mean duration of hospital treatment in these cases is about twelve days. During the past ten years, Babcock has treated all of his ectopic pregnancy cases of the alarming type by this operation and there has been no mortality and in no instance was a secondary operation necessary. The contrast between the results obtained by this method and those obtained from

abdominal section is such that he is convinced that this is the safest method yet proposed for the treatment of at least the tragic forms of rupture. We quote this but cannot advocate it, because we look upon this suggestion as a dangerous one in the extreme.

A SYMPTOM OF EXTRA-UTERINE PREGNANCY which Lehnhoff¹ considers practically pathognomonic as he has found it in no other condition, consists of a severe, sharp, cutting pain in the lower abdomen while the patient is at stool. He has found this symptom present in about 75 per cent. of the cases of ectopic pregnancy, the pain occurring, as near as can be ascertained, at the time when the abdominal muscles contract in assisting to empty the bowel.

RARE FORMS OF ECTOPIC PREGNANCY. Unfortunately, space does not permit of an extensive review of the numerous interesting cases of ectopic pregnancy that have been reported during the past year as, for example, the case of Devane² in which an ectopic pregnancy proceeded to full term. The case of Proust and Buquet,³ however, deserves attention. In brief, a woman, aged twenty-nine years, was operated upon in an emergency for sudden, severe pains and persisting hemorrhage. Both tubes contained an ovum of about two months' growth, the one tube having already ruptured, while the other was enormously congested. The adnexa were removed on both sides but the uterus was left. Forty-one similar cases have been previously reported although in only 33 cases were the bilateral tubal pregnancies actually simultaneous. Such cases as this emphasize the necessity for careful exploration of the adnexa of the opposite side in every operation for ectopic pregnancy. If a hematosalpinx is found on the other side, it should always be removed as it is likely to rupture at any time.

Tubal Sterilization. There are, at times, occasions when it is desirable to sterilize a patient without performing a bilateral oöphorectomy, or, in other words, by means of some operative procedure on the tubes alone. Although many methods of accomplishing this end have been suggested, it is surprising to note that pregnancy has occurred subsequent to the performance of almost every one of these operations. Heineberg⁴ had his interest aroused in this subject by the occurrence of pregnancy in two patients in whom he had performed bilateral salpingectomy for the relief of chronic inflammation. In order to determine the frequency of such occurrences, he made a complete review of the literature and compiled some interesting facts. There have been 25 cases reported in which sterility was expected subsequent to an operation on the tubes, in which the expectation was not realized. Of these cases, 10 occurred after simple ligation of both tubes, 3 failures occurred after double ligation and section or resection of the tube between ligatures, 7 after crushing and ligation of both tubes, 8 after bilateral salpingectomy with ligation of the uterine stumps of the tubes and 3 failures after bilateral salpingectomy with cuneiform resection of the uterine cornua. This last method of sterilization has always been

¹ Archives of Diagnosis, 1916, vol. ix, p. 139.

² Lancet, 1916, vol. exc, p. 731.

³ Rev. de Gynecologie, 1916, vol. xxiii, p. 353.

⁴ New York Medical Journal, 1916, vol. ciii, p. 107.

considered the surest method of producing the desired result. All of the writers upon the subject agree that, in performing this operation, great care should be exercised to make the wedge-shaped section of the uterine cornu deep enough to remove all of the interstitial portion of the tube and to close the opening in the uterus with two layers of sutures; the deep sutures to approximate accurately the cut surfaces of the uterine muscle, the superficial ones to bring together the cut edges of the peritoneum of the broad ligament over the repaired muscle. Notwithstanding the observance of all such precautions, failures are reported by Kuestner, Polak and Haeberlin. As a result of the information gleaned from his collective review, Heineberg concludes that there is no method of tubal sterilization which affords absolute security against conception. Simple ligation of the Fallopian tubes with either single or double ligatures has been followed by the largest number of reported failures, while excision of a wedge-shaped section from each cornu of the uterus has yielded better results than any other method.

Treatment of Pelvic Infection. In order to fully determine the end-result in cases of pelvic infection following conservative or operative treatment, Polak¹ has analyzed 500 cases of this disease that have been under his care in his hospital services. During the first years included in this report, his trend was entirely toward that of conservation; tubes were removed while the ovaries and uterus were retained; tubes were resected while the ovaries were subjected to conservative treatment such as resection and suspension. The ovaries were retained *in situ* or resected whenever possible, even though the uterus was removed. In the last few years, however, a study of the life history and clinical course of these retained ovaries has caused him to swing toward the radical and do a large number of total extirpations. It is impressive to note in the study of these latter cases, the great reduction in the primary morbidity and the great improvement in both the anatomical and symptomatic cures. Two points stand out clearly, first that there is no use of conserving the ovary and the function of ovulation unless it is also possible to preserve the function of menstruation; secondly, that the conserved ovary behaves badly in the presence of pelvic infection, it is more difficult to maintain its circulation, and the impairment of its circulation and innervation tends to create cystic formation, adhesions and pain. Polak is convinced that the removal of an ovary which has undergone changes as the result of constant contiguous infection, has less bearing on the future well-being of the woman, than the removal of an ovary that has undergone cystic changes from circulatory derangement. Clinically, ovaries imbedded in inflammatory masses have so much of their circulation and innervation disturbed, that regeneration is very imperfect, and when retained have often become a menace rather than a boon to the woman's health.

As a result of this investigation of his cases Polak believes that time works miracles in the resorption of the pelvic inflammatory masses,

¹ New York State Journal of Medicine, 1916, vol. xvi, p. 344.

consequently all acute pelvic inflammations should be treated expectantly until all exudate subsides and the temperature has been normal for over three weeks; conservation should only be attempted after all exudate has been absorbed, but if the pathology is extensive, total extirpation will give a better end-result than the conservation of vitally impaired structures.

New Technic for Salpingo-oöphorectomy. To bloodlessly remove the mass, close the gaping defect in the broad ligament and peritonealize denuded areas are the special indications in salpingo-oöphorectomy, all of which may be accomplished with rapidity by means of the following

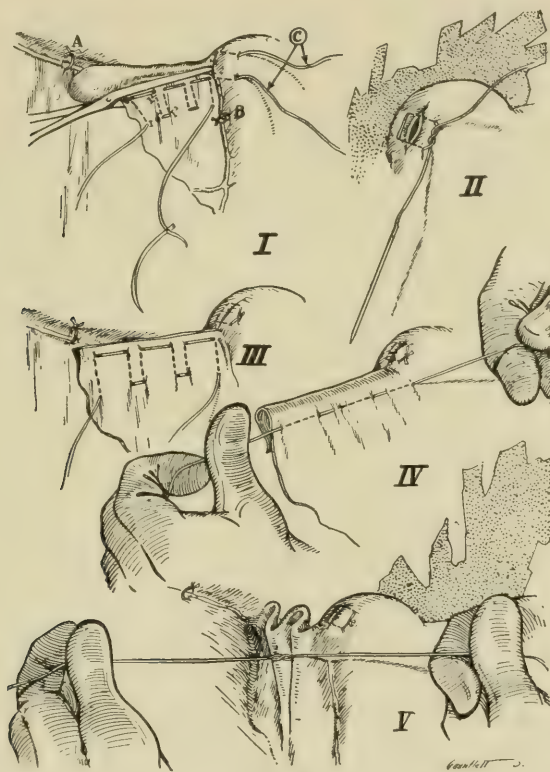


FIG. 88

technic which has been elaborated by Shaw.¹ After proper exposure and exploration, packing off, freeing mass, etc., we proceed as shown in the accompanying anatomicoschematic illustration. Fig. 88, I, shows the clamp applied along the broad ligament directly beneath the mass. The sutures first passing through the broad ligament at I and back at O, about one-eighth of an inch from clamp, are then brought through again at I² and back out at O²; in again at I³, etc., as per illustration. Usually three complete suture units are just right; however, occasion-

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 733.

ally, two will suffice. *A* represents a ligature around the infundibulopelvic ligament, *B* represents a ligature on the ascending branch of the uterine artery; *C* is a suture passed through the cornu, just above and back, below the tubo-uterine junction, which is to be tied immediately upon excision of the tube as seen in *II*. *III* shows the mass removed while *IV* illustrates how traction in the opposite direction upon each suture end draws the two separated layers of the broad ligament together and infolds the ragged edge. *V* shows the infolded edges being pleated into position and held there by tying suture, thereby closing the gaping defect in the broad ligament and restoring the normal anatomical support to the uterus.

Ultraviolet Ray Therapy. The field of gynecological conditions to be treated by ultraviolet or other light therapy has as yet been very little explored, although it has been proved that light is a bactericide and penetrates the human and other animal tissues. The rays that are invisible to the human eye at both ends of the spectrum act very differently from each other. At the red-yellow end they act by producing heat; at the blue-violet end, very little warmth is brought forth but there is an actinic action. Hellman¹ has treated 8 cases of pelvic inflammation by means of these rays and reports them as absolutely cured. They were treated as ambulatory cases without any other therapeutic measures having been employed and the diagnosis before treatment was always confirmed by at least one and sometimes three colleagues.

Apparatus. The apparatus consists of the Kuenstliche Hohensonne Lampe designed by Drs. Bach and Nagelschmidt. The quartz burner is a transparent quartz tube 0.67 cm. long, on the ends of which are two transverse tubes which contain the mercury electrodes. The electrode vessels are provided with fan-shaped metal coolers with which the heat loss and therefore the current consumption is regulated. On each electrode, between the coolers is situated the beaded lead which conducts the current to the lamp. This lamp is suspended in a casing consisting of two hemispheres of highly polished aluminum, the upper hemisphere is the casing proper while the lower hemisphere is the closing cap which is adjustable and has an aperture with a revolving screen behind it. This revolving screen has smaller apertures so that any desired amount of light may be allowed to pass. The patient is placed before the lamp in a reclining position; the part of the body to be rayed is exposed and the rest of the body is covered with a thin sheet. The eyes of the patient and anyone else in the room must be carefully protected by dark glasses. The length of exposure, short at first, is carefully lengthened according to a definite scale, always remembering that brunettes can stand longer exposures in the earlier treatments than blondes.

THE OVARIES.

Blood Supply of the Ovary. Before the American Gynecological Society in May, 1916, Sampson² presented the results of his studies in

¹ American Journal of Obstetrics, 1916, vol. lxxiii, p. 662.

² Ibid., vol. lxxiv, p. 95.

regard to the blood supply of the ovary. The material used in this work consisted of six fetal tubes and ovaries and thirty adult ones in which the arteries had been injected with bismuth and ten adult tubes and ovaries in which the veins had been injected. The specimens were studied by means of stereoscopic radiographs and for the sake of comparison ink tracings were made of the bloodvessels on prints, using the stereoscope as a guide in following the course of the individual vessels. The prints were then bleached, leaving the tracings. The investigations showed that the terminal portion of the uterine artery presented variations in its branching and distribution of those branches. This artery directly or indirectly through its branches supplied a varying portion of the ovary in all cases, the entire tube in 6, the greater portion of the tube in 23, the round ligament and greater portion of the broad ligament in all but 1. In 24 of the 30 specimens, the ovarian artery, on approaching the ovary, divided into two main branches, a lateral tubo-ovarian or tubal branch and a mesial ovarian, the latter anastomosing with the ovarian branch of the uterine. In 6 specimens the lateral tubal branch was absent. The ovarian artery supplied a varying portion of the ovary in all cases, the distal portion of the tube in 24 and portions of the broad ligament in all, but to a lesser degree than the uterine.

The actual blood supply of the ovary was a divided one, uterine and ovarian. In 26 of the 30 specimens, the uterine supplied the proximal portion of the ovary and the ovarian artery supplied the distal portion. In 4 specimens (4 of 6 in which the lateral ovarian branch to the tube was absent), the lateral tubal artery arose from the main tubal artery (uterine artery) and supplied the distal portion of the ovary, taking the place of the lateral tubo-ovarian branch from the ovarian artery. In these 4 specimens the distal portion of the ovary was supplied by the uterine, the middle by the ovarian and the proximal by the uterine. The uterine and ovarian arteries communicated with each other not only through the well-known utero-ovarian anastomosis, but also through the arteries of the broad ligament, tube and round ligament.

The actual venous outlet of the ovary was partly through the ovarian veins and partly through the uterine veins. Its potential venous outlet was evident in the various communications between the venous channels of the utero-ovarian plexus, the free anastomosis of the veins of the broad ligament and tube, and the communication of the plexus with the epigastric vein of the round ligament. The removal of the tube always encroached upon the blood supply of the ovary (the potential blood supply), and when the distal pole of the ovary was supplied by the tubal artery (four of thirty specimens), the actual blood supply of that portion of the ovary might be cut off.

The practical value of these anatomical studies lies in the suggestion that if it is necessary to remove a tube without removing the ovary, it should be done with the least possible disturbance of the broad ligament, and even then occasionally the blood supply of the distal pole of the ovary might be cut off; also in hysterectomy with conservation of the ovary, the accompanying tube should be saved if possible.

Bacteriology of Ovaritis. The bacteriology of acute infections of the ovary has been studied extensively. The possible bacterial cause, on the other hand, of chronic inflammations in the ovary, associated with sclerosis and cystic degeneration, has lacked demonstration. The work of Rosenow in demonstrating the elective affinity of certain bacteria for specific organs in such diseases as appendicitis, gastric ulcer, cholecystitis, erythema nodosum and herpes zoster is well-known to all, and now Rosenow and Davis¹ give us the results of their experiments along the same lines in connection with ovaritis, using cultures from the tissues and cystic fluid of ovaries removed at operation. Most of the ovaries studied showed, on microscopic examination, the typical chronic fibrocystic degeneration and were removed for the usual menstrual and nervous disturbances believed to be due to ovarian malfunction. Only a small proportion of the cases studied gave a history of a previous acute pelvic infection, and in only 3 cases was there present a relatively acute process. In a number, the history indicated clearly that the pelvic disturbance began after the contraction of a severe cold during the menstrual period or following definite attacks of tonsillitis. The ages of the patients ranged from 18 to 55 years. Altogether cultures were made in 64 cases; in 56 cases the records of the associated abdominal findings, as determined by laparotomy, were quite complete—fibroids of the uterus were found in 18, salpingitis in 11, chronic appendicitis in 11, and chronic cholecystitis in 8.

Results of Cultures. Two of 3 patients with acute tubo-ovarian abscesses showed pure cultures of *Streptococcus viridans* in countless numbers in the involved tissues, while the third case yielded the gonococcus in large numbers. In 10 cases the cultures remained permanently sterile. In the remaining 51 cases, in which the ovaries showed the usual fibrocystic degeneration, streptococci were isolated in 29, being present in pure culture in 7 and associated in the others with the Welch bacillus and a few staphylococci or colon bacilli. Welch bacilli were found in small numbers in 21, diphtheroid bacilli in 10, a few colonies of *Staphylococcus albus* in 9, the gonococcus in 2, the colon bacillus in 3 and an aerobic streptothrix in 1. The staphylococcus and diphtheroid bacilli are to be regarded either as accidental or harmless invaders, since injections of each do not produce lesions in animals. Intravenous injections into animals of five of the strains of streptococci showed that they were of low-grade virulence, rabbits and dogs recovering promptly. Two of the strains, however, showed elective affinity for the ovary in dogs and rabbits, and the lesions produced were striking pictures. The demonstration of the streptococcus in the lesions, the isolation of the injected streptococcus in pure form, the absence of lesions following the injection of the broth culture filtrate, and the fact that they have not seen lesions of this magnitude in numerous animals injected with streptococci from other sources, assures these investigators that the result is not accidental, but due to the peculiar properties of the injected streptococcus. As a result of their work, Rosenow and Davis

¹ Journal of American Medical Association, 1916, vol. lxvi, p. 1175.

believe that the ovaries in these chronic inflammations are infected by way of the blood stream and in support of their beliefs they cite the following observed clinical occurrences:

1. The occurrence of fibrocystic degeneration of the ovaries in which the usual streptococcus was isolated in pure form in a young woman with imperforate vagina.

2. The history of tonsillitis followed by symptoms of pelvic infection in a number of patients in their series.

3. The not uncommon occurrence of pelvic infection noted in gynecological practice following anginal attacks during the menstrual period.

4. The far more frequent occurrence of so-called idiopathic streptococcal peritonitis, following anginal attacks, in the female than in the male.

5. The absence of colon bacilli in all but three ovaries in their series is a fact which would be contrary to expectation if local invasion occurred commonly.

6. The frequent concurrence of appendicitis, cholecystitis and arthritis in these patients, diseases proved to be due usually to streptococci from a distant focus of infection.

The conclusion therefore seems warranted that fibrocystic degeneration of the ovary, even in the absence of previous acute infection, is due commonly to a low-grade hematogenous infection by streptococci having elective affinity for these structures. Owing to the fact, however, that the number of bacteria found is relatively small, and that the experimental lesions in the ovary are not due to an overwhelming growth, it is clear that while excision and resection of ovaries is indicated in some instances, it should no longer be done without due regard to the existence of chronic foci of infection which may serve not only as the place of entrance but also as the place for the bacteria to acquire the peculiar properties necessary to infect the ovary. The results suggest, however, that the eradication of primary foci of infection early in this type of patient might, in some cases, prevent the premature sclerotic degeneration of the ovary.

Peritonitis following Ovaritis of Anginal Origin. Of especial interest in connection with the work of Rosenow and Davis, which we have just reviewed, is a case of peritonitis following acute ovaritis of anginal origin which has been reported by Wilder.¹ The history is that of young girl, aged six years, who was seen on August 19th, on account of a sore throat. For two days she had felt feverish, but there was no abdominal pain. Examination revealed a temperature of 103° F., a flushed dry skin, dry lips and a heavily coated tongue. The pharynx was hyperemic, and the tonsils were large, edematous, hyperemic and studded with small, discrete, white patches. The lymph glands of the submaxillary region, and those of the upper part of the posterior cervical triangles, were enlarged and tender. The following day the patient showed marked improvement, the soreness in the throat was gone, and the temperature had dropped to 99° F. On the next evening

¹ Journal of American Medical Association, 1916, vol. lxvi, p. 569.

she had two loose bowel movements and complained of slight pain in the lower part of the abdomen. On August 22, she was found in a serious condition, with a temperature of 102° F., a rapid pulse, and rapid respiration. The abdomen was greatly distended, tympanitic and tender. The tenderness was greatest in the lower quadrants but was equal on the two sides. The leukocyte count was 28,000, with polymorphonuclears comprising 90 per cent. A diagnosis of peritonitis was made, and, although the prospects were unfavorable, operation was performed. The peritoneum was found hyperemic and lusterless and in the pelvis was a small amount of thin pus. The appendix was normal. A drain was inserted, but the child died 48 hours later. Necropsy showed an acute peritonitis, especially involving the lower part of the peritoneal cavity and pelvis, and the ovaries showed, in addition to passive congestion, small hemorrhages, and in the ovarian tissue a few diplococci with short chain streptococci were found. Cultures of the abdominal fluid obtained at operation resulted in the pure growth of Gram-positive non-capsulated diplococci and short chain cocci belonging to the streptococcus group.

Surgical Treatment of Microcystic Disease. McGlenn¹ objects to the treatment of microcystic ovaries by means of resection. This type of ovary is found in practically all cases of retrodisplacement of the uterus, when the displacement has existed for a number of years. As a result of chronic congestion, there is a thickening of the ovarian capsule, which prevents the rupture of the Graafian follicle through the surface of the ovary. As a result, retention cysts are formed, at first limited to the surface but eventually studding the entire ovary so that the ovaries increase in weight and size and naturally prolapse into the posterior cul-de-sac. On account of their abnormal position, they are subject to pressure from the full rectum or displaced uterus, and naturally give rise to considerable pain and tenderness in the pelvis. To resect an ovary of this type is only adding insult to injury, according to McGlenn, since it is impossible to remove all the thickened capsule, therefore the part of the ovary which remains has just as thick a capsule as it had before the operation. As a result of resection we do not cure these cases, but, in the majority of them, the condition is made worse. Instead of resecting the ovary, McGlenn punctures the cysts which are upon the surface with as little handling of the ovary as possible, and then suspends the ovary in its proper position by an appropriate operation. When an ovary is badly diseased and not amenable to treatment of this character, it should be removed in its entirety.

Metastatic Carcinoma of the Ovaries. The ovary has long been regarded as one of the frequent primary sites for the occurrence of malignant neoplasms, but until the beginning of the present century little attention was directed to the possibility of frequent secondary deposits in this organ, except as they appeared to be part of a general metastasis in the terminal period of the disease. In the American literature there appears to be scanty evidence that either pathologists

¹ American Journal of Obstetrics, 1916, vol. lxxiii, p. 435.

or surgeons have accepted the newer conclusions which have been expressed in quite an extensive foreign literature. Stone¹ has reviewed the literature extensively and added some material which he has examined in the Pathological Department of the Cornell University Medical College. He has reviewed the reports of 133 cases in the literature, in which the descriptions were sufficiently complete to indicate that a causal relationship existed between the ovarian and the tumors of other organs, and in which, with few exceptions, the tumors of the ovaries were undoubtedly secondary. The primary tumors occurred among different organs as follows: Stomach, 75; breasts, 25; large intestine, 22; gall-bladder, 5; small intestine, 4; pancreas, 1; appendix, 1. Stone quotes Bland-Sutton who says that for twenty years he has been suspicious that bilateral cancer of the ovaries is frequently secondary, because he has noted the presence of massive deposits in one or both ovaries in 10 per cent. of autopsies after mammary or gastric cancer. The majority of cases were operated upon under the impression that they were primary tumors, and the presence of a coexisting cancer of the gastro-intestinal tract was overlooked in spite of the presence of such typical signs as persistent vomiting and progressive emaciation. Bland-Sutton characterizes such errors as the result of an "occupation bias," by reason of which the pelvic surgeon allows the presence of a definite pelvic tumor to fill the foreground of the clinical picture, while the general surgeon too intent upon a tumor of the stomach will disregard the significance of enlarged ovaries. As a result of a careful study of this subject, Stone believes that malignant tumors of the ovary, even when of such size as to control the clinical course of the disease, are frequently enough secondary to growths in other organs, especially the stomach and breast, as always to justify a suspicion of their secondary nature before any method of treatment is advised, or a probable diagnosis is defined. The possibility of metastatic invasion of these organs should always confront the surgeon in dealing with the problem of treatment and prognosis in cases of primary growths in the stomach and breast. This is especially so in recurrences in the chest wall, or in the other breast, after operations for the removal of the primary mammary tumor. The route of metastasis is rarely a chance distribution by embolic transportation through the blood or lymphatic vessels, but occurs, either by a direct extension through the retroperitoneal lymph nodes by permeation or retrograde transportation, or by peritoneal implantation. This latter method is undoubtedly a more frequent route than has previously been supposed; and next to the liver, the ovaries, especially during the period of their functional activity, are more often involved in this way than in any of the other intraperitoneal organs, because of their circulatory changes, the traumatism of their surface from ovulation, and the proximity to the pouch of Douglas, which is apparently more frequently the site of peritoneal implantation of cancer cells than any of the other peritoneal surfaces.

The gross appearance of ovarian tumors, when they are large and extensively involved, is not characteristic, but, in the earlier stages,

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 407.

secondary invasions usually appear as distinct nodes, located in any area, and involving a small or large part of the ovarian structure. The histology of these tumors varies with the nature and location of the primary growth, but their morphology is undoubtedly altered by the changed conditions of nutrition and growth which the ovarian structure offers. The adenocarcinomatous type appears to be frequent, but a larger number are of the diffuse infiltrating type, in which the glandular structure is lost, often showing a distinctly fibrocarcinomatous structure similar to the structure of the primary tumor in the stomach or breast from which they are derived.

Thyroid Tumor in Ovary. A rather unusual case has been reported by Platou¹ of an ovarian tumor that was removed from a woman, aged fifty-four years, who had 7 living children. She had always been in good health until one year previously, when ascites developed. The microscope revealed the tumor to be entirely composed of thyroid tissue, a colloid stroma, as large as a goose egg, embedded in the ovary. A review of the similar cases which have been reported shows that no instance of recurrence after removal is known and no symptoms of myxedema have ever been noted such as might be anticipated if the thyroid tissue had proliferated in the ovary for vicarious functioning.

Bone Formation in the Ovary. The occurrence in the ovaries of little hard nodules, often called "ovarian stones," is well recognized as a not exceedingly infrequent phenomenon, but these are usually considered merely calcareous deposits in sclerotic ovaries or degenerated corpora lutea, and are probably, in most instances, never subjected to microscopic examination, without which the definite determination of the presence of bone is hardly possible. In order, therefore, to ascertain whether or not the occurrence of true bone in the ovary (aside from that found in dermoids and solid teratomas) is really as unusual as has apparently been assumed, Outerbridge² has subjected to microscopic examination, after thorough decalcification, sections from all ovaries containing hard nodules which have come into his hands. In this manner seven specimens have been studied, with the result that areas of true bone have been found in every one, sometimes of greater extent, sometimes of lesser but always clearly demonstrable. He has made a careful search of the literature and was able to collect only 14 similar cases, but in view of the fact that he has been able to personally collect from a moderate amount of pathological material no less than 7 cases in a comparatively short space of time, he believes that the condition must be far more common than might be assumed.

The question naturally arises as to the origin of bone in these cases. The first thought might be that it is always a teratomatous manifestation, in view of the frequent occurrence of such tumors in the female sexual glands and of their well-known tendency to produce bony tissue. Even in cases such as these of Outerbridge, where careful microscopic examination has failed to reveal the least indication of other abnormal

¹ Norsk Magazin for Lægevidenskaben, 1916, lxxvii, No. 4, by Journal of American Medical Association.

² American Journal of Medical Sciences, 1916, vol. cli, p. 868.

tissues, the argument might be advanced that we are here dealing with examples of the so-called "reduced" teratoma, in which it may be assumed that all varieties of tissue, save one, have been suppressed, as is believed to be the case in certain thyroid-like and other anomalous growths of the ovary, but a much simpler and more plausible explanation for the occurrence of bone in the ovary would appear to be that it arises as the result of metaplastic changes in the fibrous tissue with which that organ is so well supplied. The tendency of old fibrous tissue, especially if the seat of old inflammatory processes, to undergo calcification is, of course, well known. The occurrence of true ossification in such areas is also a matter of frequent observation, and indeed abnormal ossification has been noted in almost all parts of the body, especially the muscular system, bloodvessels, old scars, etc., and cases have been reported involving the kidney, penis, thyroid, pleura, lymph



FIG. 89.—Bone formation in the ovary.

glands and various other organs. In several of the cases considered by Outerbridge, the ossification was located in the substance of a corpus fibrosum, *i. e.*, in an area of more or less inert, avascular fibrous tissue; in others, in the fibrous tissue of a cyst wall, or in an atrophic, degenerated organ. In a number of cases, the ovary affected was associated with a chronic pelvic inflammatory process of high grade. In almost all instances the ossification was evidently secondary to more or less extensive calcareous deposits in the fibrous tissue.

Twisted Cyst Simulating Renal Calculus. Illustrative of the difficulties sometimes encountered in the differential diagnosis of ovarian cysts, especially when they cause bladder disturbances, as they often do when torsion has occurred, is a case reported by Vineberg¹ before the New York Obstetrical Society. The patient, twenty-four years of

¹ American Journal of Obstetrics, 1916, vol. lxxiii, p. 486.

age, married twelve months and pregnant two months, was admitted to a surgical service for renal calculus. Fourteen months previously she was suddenly seized with severe pain in the left loin which radiated anteriorly and downward to the vulva. The pain was knife-like in character and of such severity as to necessitate the administration of morphine. She had four similar attacks shortly before admission. During the attacks she suffered from nausea but did not vomit, and she had frequency of micturition but voided urine of a normal color which was microscopically negative. An x-ray examination showed irregular shadows overlying the shadow of the pole of the left kidney, one of the shadows being three-fourths of an inch in diameter and of a mulberry appearance. Upon vaginal examination, the uterus was found enlarged to the size of a gravid organ at about eight weeks, but nothing else was noted and cystoscopic examination revealed nothing abnormal. On the basis of the clinical history and the Röntgen findings, a nephrotomy of the left kidney was performed with a negative result. The patient was discharged from the hospital but was readmitted three months later on account of the recurrence of a similar attack in which the pain was very sharp and was attended with vomiting, the pain radiating over the entire lower part of the abdomen. Urination and defecation were attended with pain. She had aborted shortly after leaving the hospital. Examination now revealed lower abdominal rigidity, slight enlargement of the uterus and an indefinite mass behind and to the left of the uterus. This mass continued to increase in size and laparotomy was performed, disclosing a cyst of the left ovary about the size of a closed fist, almost black in color and with pedicle twisted two and one-half times. In the mesentery of the splenic flexure of the colon, three calcareous glands were found, corresponding in size and position to the shadows in the Röntgen picture.

THE VAGINA AND VULVA.

Vesicovaginal Fistula. Cases of vesicovaginal fistula where the lumen does not exceed one-quarter of an inch have been successfully repaired many times by a "trick" operation by C. H. Mayo,¹ although he claims no originality in the method.

Technic. An incision is made through the vaginal mucosa extending completely around the fistulous opening about one-quarter of an inch or less from its margins. The vaginal mucosa is dissected toward the opening, care being taken not to break through at the margin. This makes a little cup or funnel-shaped opening projecting into the vagina. The circular dissection is carried deeper around the fistula, not approaching nearer than one-eighth of an inch to the margin, its depth penetrating to the mucosa of the bladder but not through it. This leaves a little bell or funnel-shaped opening lined with mucous membrane which is connected with the mucosa of the bladder and projects into the vagina. A ligature carrier is passed through the urethra into the blad-

¹ *Annals of Surgery*, 1916, vol. lxiii, p. 106.

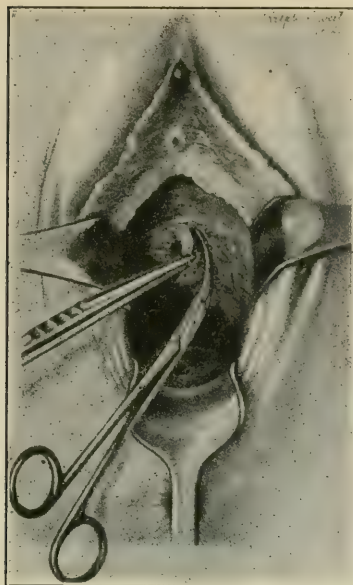


FIG. 90

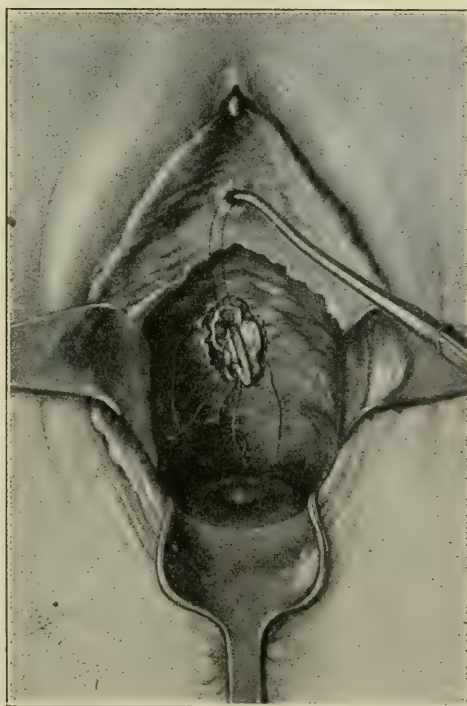


FIG. 91
15

der and through the fistula into the vagina. A suture is passed through both walls of the funneled mucosa on each side of the ligature carrier. The two ends of the suture are now threaded into the ligature carrier which is withdrawn from the bladder and urethra. The ends of the suture projecting from the urethra are drawn upon, and, with a little aid, the fistulous tract starts inverting. As soon as the mucosa disappears, a circular suture of fine chromic catgut is applied, a little more traction is used on the ends of the long suture and a second purse-string suture is applied. The vaginal side is now closed either by a circular suture of chromic catgut or by interrupted sutures as seems best. This inversion turns the mucous surface into the bladder and

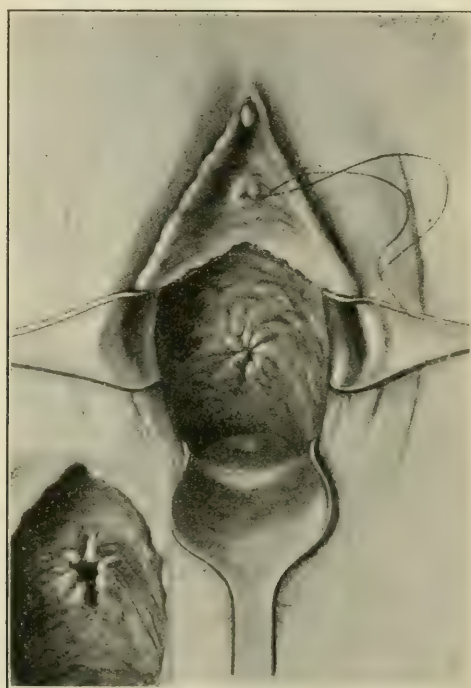


FIG. 92

leaves a healing surface within the tube. One of the long ends of the suture projecting from the urethra is rethreaded and by a needle is sutured to the skin of the labia. The two ends of the suture are now tied at this point making slight traction. A self-retaining catheter (Pezzer type) is inserted into the bladder and the patient instructed to rest on her side or even on her face in order to keep the fistulous area free from pressure of the urine. After four days it is necessary to watch the catheter in order that sediment or phosphatic deposits do not obstruct the lumen and in some cases irrigation is necessary. After a week, the repair is usually solid but it is better to keep the patient on her face or side for a few days longer in order that no undue strain

may be placed on the fistulous tract. The silk suture within the bladder either cuts itself loose on account of the slight traction before it is time to remove the catheter, or it may be drawn out without difficulty by cutting one side where it is attached to the skin.

Cervicovesical Fistula. With the common vesicovaginal fistula, the probability of exposure of the fistulous tract from below is greater than in cases of cervicovesical fistula, and although cicatricial contraction may render such exposure very difficult, repair can eventually be effected provided that freeing of the edges of the fistula from the scar tissue be carried out as a preliminary stage. The cervicovesical fistula presents two fresh difficulties, inaccessibility to the fistula from below, and the necessity of maintaining the patency of the cervical canal. In many of these cases, the anterior lip (sometimes also the posterior) of the cervix has disappeared, and there is therefore no means of dragging the upper part of the vagina into view. To attempt repair of such a fistula from below is neither wise nor profitable, according to Maxwell¹ who calls attention to the ease of approach by the abdominal route. He states that the suprapubic route is the ideal method of approach if,

1. The fistula be difficult of access from below;
2. A large degree of vaginal cicatrization be present;
3. Several previous attempts at repair from below have failed;

4. The fistula be anterolateral in the vicinity of the ureter. In brief, the technic of the suprapubic operation, as described by Maxwell, after the abdomen is opened, consists of incising the vesico-uterine peritoneal fold and stripping down the bladder so that the fistulous tract is exposed from above. Fine chromic catgut sutures are inserted to approximate the edges of the vesical mucosa, followed by the insertion of a superimposed tier of catgut sutures through the bladder muscle. The vesico-uterine peritoneal fold is then closed, completing the operation. The scar tissue which will almost inevitably result from these operations for repair of fistula, will certainly interfere with the normal upward displacement of the bladder in the first stage of labor, besides leading to a certain degree of stenosis of the birth canal. Therefore the patient should never again be allowed to run the least risk of a second injury to her bladder; in the event of her becoming pregnant again, Cæsarian section should be recommended as the sole method of delivery.

Bactericidal Property of Vaginal Secretion. In order to determine the elements of the vaginal secretion which are responsible for its bactericidal action, Harada,² working in the Obstetrical Department of the Kyoto Imperial University in Japan, performed some very interesting laboratory experiments. The method of procedure which he followed consisted of collecting, in sterile capillary pipettes, the white vaginal secretion from pregnant women (usually obtainable in quantities of only 0.05 to 0.2 c.c. from each woman). The specimen was then diluted in from one to five or ten parts of physiological salt solution, after which

¹ Practitioner, 1916, vol. xevi, p. 159.

² American Journal of Medical Sciences, 1916, vol. clii, p. 243.

0.4 c.c. is taken up in a test-tube. Next, one loopful of a fresh agar culture of such bacteria as are applied to test bactericidal power, namely, streptococci, staphylococci, *Bacillus coli*, *Bacillus typhosis*, etc., is put into 10 c.c. of sterilized water. After thoroughly stirring, 0.05 c.c. of the mixture is taken up in a sterile capillary pipette, added to the vaginal secretion above referred to, and shaken very thoroughly so as to obtain an intimate mixture which is then placed in the incubator at 37° C. for several hours, after which 0.05 c.c. is removed for agar plate culture. The colonies produced are counted, and the strength of the bactericidal power of each sample of vaginal secretion is noted for comparison. A summary of the results obtained by this work shows that the bactericidal property of the vaginal secretion in pregnant women is not greatly affected by different bacilli, but this property is gradually increased during the course of pregnancy. The normal secretion contains 0.9 per cent. of lactic acid, but this percentage does not increase during the course of pregnancy so that lactic acid *per se* is not the sole cause of this bactericidal power, as has been stated by Doederlein, although its influence is not insignificant. Harada is convinced that the bactericidal substance, whatever it may be, is not of the nature of a bacteriolysin which is completed by association with complement, but it is due to the presence of substances which he calls *leukin* and *cytase* and lactic acid. Though Menge and Kroenig have stated that the bactericidal property is caused by such agents as tissue juice, lack of oxygen, the vaginal bacillus and products resulting therefrom, Harada has found these statements to be erroneous.

Gonococcus Complement-fixation Test. From the experience gained from the performance of 423 complement-fixation tests for gonorrhea, Warden and Schmidt¹ concur in the opinion that positive reactions are always of value and repeated negative reactions, in the absence of clinical signs, are of great value, but a single negative reaction is of no value whatsoever. While, in their series, the sera of normal persons have been wholly negative, and while it is admitted that positive reactions are largely confined to cases in which the gonococcus is, or has recently been, present, nevertheless the evidence as a whole leads them to believe that a positive reaction indicates the presence in the serum of some substance which reacts with the antigen, perhaps an antibody, to produce fixation of the complement, and not necessarily the presence of a focus of gonococci in the body. In regard to the technical considerations of the test, Warden and Schmidt have found that an alcoholic solution of the fats of the gonococcus serves as an antigen and is superior for this purpose to the watery antigen of commerce.

Lactic Acid Treatment of Vaginitis. Cohen² has experimented with the Bulgarian lactic acid bacillus in the treatment of vulvovaginitis, and claims that the bacillus does not thrive in the human vagina, and is therefore of little use in such cases.

Primary Carcinoma of the Vulva. Compared to the frequency of carcinoma of the internal genital organs in women, primary carcinoma

¹ Journal of Laboratory and Clinical Medicine, 1916, vol. i, p. 333. ² Ibid., p. 757.

of the vulva is a rare affection. The disease is distinctly one of advanced life, the patients, as a rule, being women who have reached the late sixties or seventies. Stein¹ has recently reported a case of primary carcinoma involving the upper two-thirds of the right labium majus, the upper third of the left labium majus, clitoris and the upper junction of the labia minora, and has appended to his report a fairly complete review of the accepted facts regarding this form of carcinoma. The etiology, of course is undetermined, but although a direct connection is not always demonstrable, predisposing factors are probably to be sought in warty excrescences and papillomata of the skin. The site of predilection of vulvar carcinoma seems to be in the labia majora and minora as well as the clitoris. Especial importance is to be attached to the early involvement of the regional lymphatics, the external inguinal glands representing the first stage, the deep inguinal glands the second stage, the external iliac, hypogastric and obturator glands the third stage of cancerous invasion. The vulvar lymphatics, however, are far from being confined to a perfectly definite glandular group since when one-half of the vulva is injected, the mass may frequently be seen to reach the glands of the opposite side. This may be due to one of two processes; sometimes it is effected on account of the continuity of the network of origin of the two sides of the vulva in the middle line, in other cases it is due to the fact that some of the collecting trunks cross the middle line and end in the inguinal region of the opposite side. The clinical importance of this fact may be readily appreciated since it should be borne in mind that when dealing with any case of epithelioma of the vulva, the inguinal glands of *both* sides should be regarded as liable to infection.

Carcinoma of the vulva may not cause any disturbances for a considerable length of time and is apparently painless until the growth has ruptured through the skin. The patient, therefore, is not apt to seek advice before ulceration has begun and often complains only of local soreness and a burning sensation on micturition. There is usually a history of a small painless nodule or a superficial ulcer with a tendency to bleed more or less, gradually increasing in size without serious disturbances of a local or general character. Profuse discharges and hemorrhage are rare and never appear until late in the disease but pruritus is in many cases one of the earliest symptoms of vulvar carcinoma.

Treatment. In view of the hopeless prognosis in neglected cases which reach the surgeon too late, early operative intervention is imperative. The unfavorable outlook of vulvar carcinoma can be improved only by radical operative measures, abandoning the older method of removing only the external inguinal glands. Even when not demonstrably diseased, these glands must be extirpated without fail on both sides on account of the early occurrence of metastases in this region, due to the number of deep anastomosing lymphatics in the mons veneris. Provided the carcinoma has not yet attained considerable size and the lymphatic glands are not yet changed or suspicious, the extirpation may be restricted to the removal of the superficial and deep inguinal

¹ American Journal of Obstetrics, 1916, vol. lxxiv, p. 577.

glands on *the two sides*. Very radical procedures, including the removal of the deep iliac and hypogastric glands, are indicated in the presence of a large ulcerative tumor, especially of the most malignant infiltrative type, and in youthful or pregnant women. The tumor must be extirpated well within the healthy tissue and expert operators evacuate both inguinal regions down to the bloodvessels, dissecting the glands, fat tissue and lymphatics in connection with the growth.

Radiation with *x*-rays, radium and mesothorium is a recent addition to the treatment of vulvar carcinoma, but has led to such contradictory results that there is no unanimity concerning its value in these cases.

The number of permanent cures, accepting as the standard the patient's freedom from a recurrence for a postoperative period of five years, is deplorably small judging from the figures given by Kehrer, who emphasizes moreover that recurrences have been known to follow at the end of six, seven, or even eleven, years after operation. Accordingly, the five years' freedom from recurrence, which is usually the measure of a permanent cure in cancer of the uterus, does not apply to carcinoma of the vulva, which can hardly be regarded as definitely cured when six or seven years have elapsed since the operation.

MENSTRUATION.

Relation of Corpus Luteum to Menstruation. In order to study the normal life-cycle of the corpus luteum in relation to the menstrual cycle, and also to determine whether any histological variations in the lutein structures of the ovary can be found to explain the various menstrual disturbances, Novak¹ studied clinically and histologically 137 cases from the Gynecological Department of the Johns Hopkins Hospital. In 102 of the cases in this series, both ovaries had been removed, together with the uterus, so that it was possible to study the histological picture of the endometrium side by side with the histological variations in the removed ovaries. The latter were thoroughly ransacked by numerous sections for all traces of lutein tissue, as well as other characteristic structures which might be of functional importance. A careful study was thus made not only of corpora lutea in various stages of development, but also of other structures, such as mature Graafian follicles, atresic follicles, etc. In this way it would seem that the possibility of overlooking structures of functional importance could be reduced to a minimum, since the presence of such elements can usually be easily determined macroscopically. With a few exceptions, those who have studied the corpus luteum in the past have seemed to disregard the fact that, like the endometrium, it undergoes a change from day to day. The stereotyped conception of the corpus luteum seems to have been that of a large structure, with brilliant yellow undulating walls, standing out sharply from the cut surface of the ovary. While this description fits the corpus luteum in certain stages of development, it is altogether incorrect as applied to others. The

¹ Journal of American Medical Association, 1916, vol. lxvii, p. 1285.

above-mentioned characteristics are apt to be those of the fully developed corpus luteum, which has, however, reached this stage only after a process of gradual development extending over many days. In its earliest stages, just after rupture of the Graafian follicle, the corpus luteum is usually a small collapsed structure, with thin, moderately undulating walls, which are of grayish-yellow hue instead of the brilliant yellow color of the later stages. For this reason the earlier stages are very inconspicuous and are usually overlooked. Indeed, according to Novak, their discovery, even with careful search, must be looked upon as in large measure accidental. In the five specimens of early corpus luteum which are considered in this article, there is a noted similarity in the very important particular that in all of them the epithelial cells of the granulosa are intact. This fact is of prime importance in the consideration of the origin of the lutein cells. One of the strongest arguments against the epithelial origin of these cells has been the alleged degeneration and disappearance of the membrana granulosa after rupture of the follicle. In each of Novak's five specimens, however, the epithelium was well-preserved, and in two of the cases it exhibited definite signs of a lutein-like transformation, which he looks upon as a vital point—the vital point—in connection with the question of the origin of the lutein cell, since if we can demonstrate in human beings, as seems to have already been shown in lower animals, that there is a direct transformation of the granulosa cell into the lutein cell, the problem is solved. The theca cells, on the other hand, while epithelioid and fatty shortly after follicular rupture, soon exhibit a retrogression to the ordinary connective-tissue type, and if, as almost seems certain, the paralutein cells are derived from the theca interna, the lutein zone must represent the transformed granulosa.

A careful analysis of the cases on which this report is based has failed to reveal anything like a direct relation between the degree of lutein development in the ovary and the clinical intensity of the menstrual flow. Speaking generally, the corpus luteum from a case of excessive menstruation shows no greater development than that from a case of scanty menstruation at a corresponding stage in the menstrual cycle. Such a conclusion is not justified, however, unless both ovaries are thoroughly ransacked in all parts so that no lutein structures will be overlooked, as has been performed in this study.

Glandular Therapy at the Menopause. Corpus luteum extract in tablet form has been in use for a considerable time with varying success in the treatment of scanty menstruation and the menopause, both natural and surgical. Large doses are usually recommended, which, aside from the expense, are often the cause of nausea, necessitating the cessation of the administration. Hirst¹ has overcome the nauseating effect of the product and still retains its therapeutic value by giving the drug by intramuscular injection, using a dosage of from 10 to 15 grains every day for two or three weeks, then gradually reducing the frequency of administration.

¹ American Journal of Obstetrics, 1916, vol. lxxiii, p. 648.

Pituitary extract was used in a case of premature menopause by Jona¹ with success. In this case, the menopause came on after an attack of puerperal fever at the age of twenty-nine. Besides the amenorrhea, a tendency to obesity, hypertrichosis and polyuria developed, with vascular crises and change of character. After ten or twelve years, pituitary treatment was begun, and before long menstruation returned and the general health improved, the menopause thus retrogressing. This case of premature and pathological menopause emphasizes anew the share of the mechanism for internal secretion in the normal menopause and it accentuates the pituitary element. The case is further interesting as showing the possibility of menstruation returning, after a pause of twelve years, under the influence of hypophysis treatment, which also caused the subsidence of certain still persisting climacteric disturbances. The patient was under intermittent pituitary treatment from August to March, and the menstrual flow had recurred regularly up to the time of the report.

GYNECOLOGICAL PATHOLOGY.

Cause of Hemorrhage in Myoma Uteri. The commonest, and perhaps, the most important, symptom associated with uterine fibromyomata is undoubtedly hemorrhage, either in the form of menorrhagia or metrorrhagia. It has been the aim of many investigators to arrive at some definite explanation to account for this hemorrhage, but as yet no conclusive evidence in support of the various theories has been advanced. Hyperplastic changes in the endometrium have been noted as a common occurrence associated with bleeding and fibroids, and consequently these conditions have been correlated by some authors. Others have attempted to link the hemorrhage with inflammatory changes, either in the endometrium or in the wall of the uterus. As would seem natural, because of the size and situation of these tumors, mechanical causes, as pressure or obstruction with dilatation of the vessels, have been assigned an important role in the etiology of the hemorrhage. One important organ, however, has been neglected, but in the light of recent contributions to the physiology of menstruation and of the demonstration of amenorrhea produced by the x-rays in treating fibroids and other conditions, the definite part played by the ovaries in the causation of hemorrhage must be emphasized. Geist² whose investigations into the cause of bleeding in cases of fibrosis uteri were extensively reviewed last year,³ has studied 75 fibromyomatous uteri, representing all types of tumors and presenting various symptoms, in an attempt to correlate these various theories, especially in the light of the newer views concerning the physiology of menstruation and its relation to corpus luteum evolution. In all of the cases the menstrual history was accurately investigated, and in 60 cases the adnexa were

¹ *Gaz. degli Osp. e delle Clin.*, 1916, vol. xxxvii, p. 417, by Journal of American Medical Association.

² *Surgery, Gynecology and Obstetrics*, 1916, vol. xxiii, p. 68.

³ *PROGRESSIVE MEDICINE*, June, 1916, p. 291.

examined in addition to the tumor. Fifty cases gave a history of menorrhagia, some few also having metrorrhagia, of which 36, or 72 per cent., showed hypertrophy of the mucous membrane of the uterus irrespective of the phase of the normal menstrual cycle. Of the cases that showed abnormal bleeding but did not present the usual hypertrophic mucosa, 5 showed a condition of slight hypertrophy and edema with some tortuosity and dilatation of the glands; in other words, a mild attempt at the picture. Three cases had atrophic mucosa with large tumors; the atrophy, however, occurred over the tumors and on the uterine wall opposite them, where the question of pressure undoubtedly played a prominent part, while the mucosa between the tumors showed decided hypertrophy. Five cases presented the typical interval or resting mucosa for which Geist can offer no explanation. Of the 25 cases in which the menstrual history was normal, there were but 9, or 36 per cent., that presented the hypertrophic change, and 14, or 56 per cent., showing an interval stage. Of the 9 cases with normal menstrual histories in which the mucosa was hypertrophic, 1 was menstruating on admission, 7 were operated upon at the time of the normal premenstruum, 1 had amenorrhea for four months, while only the last case can not be explained as due to physiological causes. In other words, irrespective of the size and situation of the tumor in those cases giving a history of menorrhagia or metrorrhagia, and irrespective of the phase of the menstrual cycle, there was a markedly hypertrophic mucosa which was not due to edema alone since all the elements of the endometrium took part in the change. The glands were tortuous, distended, often cystic and sometimes increased in number. The cells lining them were large, with pale staining protoplasm and contained basal or centrally placed nuclei, dark staining and oval in shape. The entire histological picture resembles very much the changes one finds in the mucosa during its normal premenstrual phase, and it seems reasonable to Geist to suppose that the same stimulus, namely, some ovarian activity, is the cause of the hypertrophy found associated with fibroids. In the uteri from the cases of essential uterine hemorrhage¹ we find a similar hypertrophy of the mucosa and this type of hemorrhage is now generally conceded to be due to a disturbance of the balance of the endocrinous glands.

In an effort to ascertain if there were any definite lesions in the ovaries, these organs were carefully examined in 55 cases, of which 38 gave a history of bleeding and the remaining 17 had a normal menstrual history. The most important feature noted was the predominance of one type of lesion in the ovary, namely, the persistence of a large corpus luteum which was occasionally cystic. In 16 cases, or 62 per cent., of the 26 cases with hypertrophy of the endometrium, this condition of persistence of the corpus luteum was found, and in only 3 instances were the ovaries to be classified as absolutely normal. In the 9 cases in which the mucosa was in the resting stage, only 2 showed this ovarian change and in 1 of them there was a slight hypertrophy of the endometrium. Of the 17 cases in which the menstrual history was normal,

¹ PROGRESSIVE MEDICINE, June, 1916, p. 291.

only 2 showed the large corpora lutea, and in these there was a premenstrual change in the mucosa. An analysis of the foregoing cases shows that when the mucosa is hypertrophic and pathological bleeding is present, the ovary is grossly abnormal presenting either cysts, inflammation, or most commonly, a large corpus luteum, often cystic in character. Geist concludes, therefore, that because of the resemblance between the histological picture of the hypertrophy associated with the bleeding and that normally present in the premenstrual phase, which latter condition has been shown to depend on some ovarian function (probably the corpus luteum), we are justified in believing that the change seen in the bleeding fibroid cases is an expression of disturbed ovarian function and that the bleeding and hypertrophic mucosa have a common or related etiological factor. In further support of this theory can be advanced the evidence of *x*-ray therapy since it is established that the *x*-ray treatment of bleeding fibroids quickly stops the hemorrhage long before the size of the tumor is influenced. We also know that it is the ovary and more particularly the more mature follicles that are first affected by the ray, and, consequently, we may feel justified in regarding, not the tumor but the ovary as the important factor in the cause of bleeding.

Adenomyoma. Cullen¹ has added two more cases of adenomyoma to his already large list during the past year, one of these being situated in the rectovaginal septum, while the other² involved the round ligament.

Myomata occurring in the septum between the vagina and rectum have long been known, and some of them have reached such a size as to encroach markedly both on the vagina and rectum. From the cases of adenomyoma of the rectovaginal septum that Cullen has been able to collect, he has made the following tentative classification:

1. Small adenomyomas lying relatively free in the septum.
2. Adenomyomas adherent to the posterior surface of the cervix and at the same time to the anterior surface of the rectum.
3. Adenomyomas gluing the cervix and rectum together and spreading out into one or both broad ligaments.
4. Adenomyomas involving the posterior surface of the cervix, the rectum and broad ligaments, and forming a dense pelvic mass that cannot be liberated.

Of course, one group merges imperceptibly into another, and a case which today belongs to group 1 may in a few years belong to group 2 or to group 3. Upon vaginal examination, one can detect a definite thickening which may be situated in the posterior wall to the right or left of the cervix, but is usually directly behind it. It may vary in size from 1 to 3 or 4 cm. in breadth and is occasionally nodular, but as a rule is diffuse, hard and reminds one of inflammatory tissue or a small adherent myoma. In some cases, the nodule moves with the cervix as if the two made up a single piece, while in other cases the nodule also seems firmly fixed to the rectum. In a few cases the vaginal mucosa over the nodule has been puckered and is of a bluish tinge. Upon rectal examination, these tumors, if situated directly behind the cer-

¹ Journal of American Medical Association, 1916, vol. lxxviii, p. 401.

² Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 258.

vix, can often be more clearly felt than through the vagina and if the growth be adherent to the rectum, the bowel over this area is splinted and hard and does not yield. The rectal mucosa, however, even over the growth, is, as a rule, perfectly normal, although the tumor may project slightly into the bowel. All of the cases thus far reported have occurred in women who were still menstruating and the most pronounced symptom was profuse menstruation, painless in some cases, in others, accompanied by great discomfort. Rectal pain was also a prominent feature in some cases. When the growth is small, is not adherent to the rectum and has not spread out into the broad ligament, there will be few, if any symptoms. In those cases, however, in which the adenomyoma has become adherent to the rectum, there is a tendency to pain

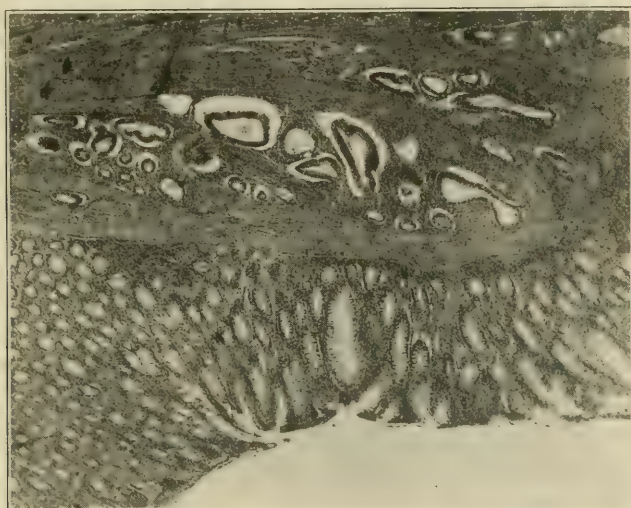


FIG. 93.—Adenomyoma of the rectovaginal septum. The rectal mucosa is normal. Some of the glands of the adenomyoma are small and round; others are large. The large glands have a thickened epithelium and correspond to the characteristic picture noted in hyperplasia of the endometrium. Nearly all of the glands are surrounded by the characteristic stroma of the uterine mucosa. At the right limit of the section one of the uterine glands is lying in direct contact with the rectal mucosa.

in the rectum, with or without painful defecation. When the growth has invaded the broad ligament and encroached on the nerves, there will be discomfort referable to this region due to pressure on the nerves and the swelling of the tumor.

Histologically, these growths, whether large or small, discrete or diffuse, consist of non-striped muscle and fibrous tissue, and have scattered throughout them typical uterine glands, which may occur singly and lie in direct contact with the muscle or may be found in groups. As a rule, they are separated from the muscle or fibrous tissue by the characteristic stroma of the uterine mucosa and at many points one can see islands of stroma devoid of glands. In some of the glands, fresh blood may be found, but more frequently yellowish-brown pigment is noted in clumps scattered throughout the stroma, this pigment being the remnant of old bleeding.

In regard to the method of *treatment* to be employed in dealing with these tumors, Cullen states that when small, discrete nodules exist in the posterior vaginal vault, they may be readily removed through a vaginal incision; when, however, the growth occupies the posterior surface of the cervix and extends laterally, after the ureters have been carefully dissected out, a complete abdominal hysterectomy should be performed. If the growth be firmly adherent to the rectum, a wedge of the rectum should be removed, together with the uterus. It has been found best, after freeing the uterus on all sides, to open the vagina anteriorly and laterally. The uterus and rectum can then be lifted farther out of the pelvis, thus facilitating the removal of the necessary wedge of the anterior rectal wall. The uterus really acts as a handle, and the necessary rectal tissue and the uterus are removed as one piece. Where the lumen of the bowel is greatly narrowed, a complete segment of the rectum should be removed with the uterus and an anastomosis should be made. In desperate cases, when everything in the pelvis is glued together, an ideal operation is out of the question. The patient will not stand a long operation, and, if she could, a satisfactory result could not be obtained. In such a case it would be better to cut across the sigmoid, invert the lower end, close it, and bring the upper end out through the abdominal wall of the left iliac fossa, making a permanent colostomy. When the patient has to some extent regained her strength, the uterus, the lower portion of the rectum and the broad ligament tissue can be shelled out as one piece. These growths, while histologically not malignant, remind one of glue and unless they are completely removed, further trouble is liable to occur.

THE FEMALE URINARY SYSTEM.

Pyelography. Notwithstanding the fact, as was stated last year¹ that there are definite dangers associated with the performance of pyelography, especially in certain types of cases, the literature still occasionally, indeed too frequently, contains reports of fatal terminations resulting from what has been considered a simple and harmless diagnostic aid. For example, Simmonds² reports a case of death following pyelography, which he ascribes to septic infection. The patient, a man thirty-four years of age, had 15 c.c. of a 5 per cent. solution of collargol injected as usual into the right kidney pelvis for pyelography on account of vague symptoms from this kidney. Afterward there was a transient feeling of oppression in the organ and a little vomiting that evening. By the next day the patient had no further disturbances except a slight painfulness in the kidney region and the urine was slightly tinged with blood. The temperature began to go up in the evening and the following day there was a hemorrhagic exanthem, with high fever and anuria, death following the third day after pyelography. Necropsy showed streptococcus sepsis and disclosed erosions in the

¹ PROGRESSIVE MEDICINE, June, 1916, p. 293.

² München. med. Wchnschr., 1916, vol. lxiii, No. 7, by Journal of American Medical Association.

ureter caused by the catheterization, which had opened a way for the streptococci into the blood. Whether the streptococci were from the bladder or the urethra is not known, but they were evidently carried up and into the tissues by the collargol which did not have enough bactericidal power to render them harmless. This case warns us that when infectious germs are known to be present in the lower urinary passages, pyelography had better not be attempted.

It is interesting in this connection to note a series of experiments performed by Braasch and Mann¹ of the Mayo Clinic in order to study the comparative effect of retention in the kidney of the various media employed in pyelography and to determine whether the retention of chemical irritants in the renal pelvis would produce lesions of that organ. The method of procedure consisted of producing either a complete or partial occlusion of the ureter of a dog after injecting the substance to be tested into the pelvis of the kidney. The routine technic was to expose the ureter, usually the right, through a lumbar incision and carefully dissect it free for a short distance, about two inches, from the kidney. If the occlusion was to be made complete, the free portion of the ureter was ligated and the solution injected through it into the pelvis. The ureter was again ligated proximal to the needle and sectioned between the ligatures. When only a partial occlusion was made, the ligature was tightened over the needle at the point where it entered the lumen of the ureter. As the results did not materially differ in the two types of cases, all of the experiments will be reported together. The capacity of the dog's kidney varies, but is practically always greater than 1.5 c.c. but in order to avoid immediate distention of the pelvis, only 1 c.c. was injected. After injecting and ligating the ureter, it was replaced and the wound carefully closed. The specimens were obtained at various times after injection, but were approximately the same for the different substances used.

The effects of retention of the following substances were studied: 1 per cent. solution of sodium chloride, saturated solution of boric acid, saturated solution of sodium citrate, methylene-blue, 5 per cent. collargol, 25 per cent. collargol, 25 per cent. argyrol, 25 per cent. car-gentos, washed staphylococci, emulsion of silver iodide, silver iodide in quince seed emulsion, 15 per cent. solution of neutralized thorium nitrate, 20 per cent. solution of thorium nitrate as used clinically, 20 per cent. solution of thorium nitrate unneutralized. The changes due to the injected solution varied, but in general they consisted of areas of focal necrosis with or without actual demonstration of the localized substance. These areas were usually located in the cortex but have been found in the medulla, and the lesion usually appears to consist of an accumulation of the substance in the tubules of the kidney but it was not definitely determined whether the substance reached the cortex through the tubules or by way of the blood and lymphatic vessels. Observations tend to show that in some instances either route may be followed. In a few instances, lesions of the uninjected kidney have proved that the substance was absorbed and excreted. The

¹ American Journal of Medical Sciences, 1916, vol. clii, p. 336.

lesions which follow excretion of the substance are usually located in the medulla and are characterized by infiltration of large, deeply staining cells. When organization takes place, there is first formed an area of necrosis and hemorrhage in the immediate vicinity of the substance. Later, a definite wall of connective tissue forms, with absorption of the necrotic material.

The data derived from this experimental work have led Braasch and Mann to conclude that mild chemical irritants, such as sodium chloride and boracic acid, when injected and retained in the pelvis of the kidney, do not produce lesions of that organ. Likewise, the effect of methylene-blue was practically negligible. More stringent chemical irritants, such as sodium citrate and 20 per cent. thorium nitrate, when tested in the same drastic manner, produce lesions of the kidney which seem directly due to the chemical injected and not to any concomitant

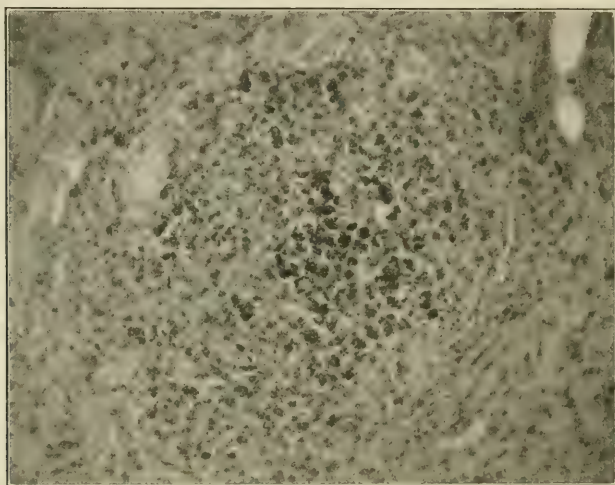


FIG. 94.—Photomicrograph ($\times 200$) showing a localized area of carentos thirty days after injection.

or subsequent infection. Argyrol, collargol and carentos were about equally responsible for producing the most marked changes noted, and it was often possible to find areas in which the metal could be distinguished. The weaker solutions of colloidal silver did not appear to be less harmful than the stronger and more concentrated solution, while the silver iodide preparations produced less changes in the kidney than the other silver solutions. Of the two preparations of silver iodide, the one in which it is suspended in quince seed emulsion caused the least necrosis. In the five experiments in which 15 per cent. thorium nitrate solution was injected, a slight lesion was noted in one case. In order to test this substance to a greater extent, in one experiment the pelvis of the kidney was overdiluted with 5 c.c. of the solution, while in a second experiment 2.5 c.c. were injected. The first specimen was examined after four days and the second specimen was examined after

fifteen days, but in neither were there any changes noted which could be attributed to the injected solution. On the other hand, the injection of a 20 per cent. solution of thorium nitrate neutralized as used clinically was performed in 10 cases and produced lesions of varying grades of severity in 5 cases in 2 of which the kidney was very badly damaged. It is suggestive that in these 2 experiments the solution was used immediately after it had been made, and it is possible that an old solution is better than a freshly prepared one. In the other three experiments in which lesions occurred, cultures of the tissues and smears made from pelvic fluid were negative for bacteria.

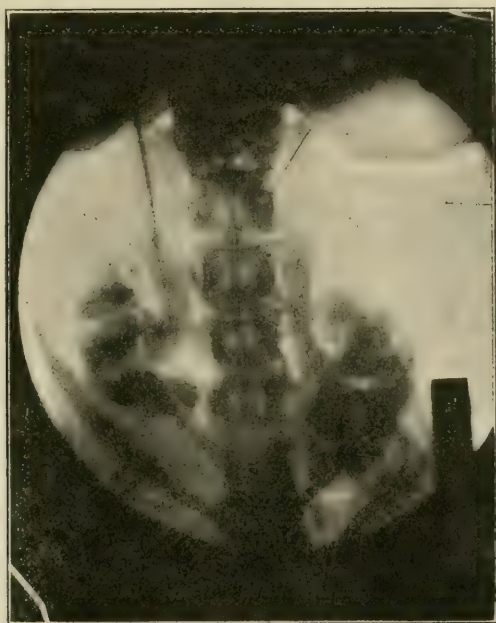


FIG. 95.—Double pyelogram showing bilateral hydronephrosis and hydroureters.

Clinical reports on the use of thorium have been published by Burns¹ who was the first man to describe the use of thorium in pyelography. His statements are based on his experience with this medium in the James Buchanan Brady Urological Institute in Baltimore, having used it in over 200 cases. Although the amount used in a single case has varied from a few c.c. to almost a liter, there has never been the slightest evidence of toxicity observed. That the solution is non-irritating is shown by the absence of urinary symptoms after its use, and the absolute lack of any such evidence cystoscopically and at operation. Burns believes that thorium fulfils all the conditions necessary for an ideal pyelographic medium. The pyelograms and cystograms made

¹ Johns Hopkins Hospital Bulletin, 1916, vol. xxvii, p. 157; American Journal of Röntgenology, 1916, vol. iii, p. 482.

with this solution show a splendid shadow which possesses an unusual clearness of delineation, as may be seen in the accompanying photograph. The solution is clear and watery, possessing a great degree of fluidity, permitting its ready elimination from the urinary tract. It is perfectly clean and does not stain the linen; in this particular it possesses another marked advantage over other solutions, particularly those of the silver salts. In addition, it is quite inexpensive, being only about one-third as costly as collargol.

NEW MEDIUM FOR PYELOGRAPHY. McConnell¹ complains of the expense of collargol which has been practically unprocurable since the beginning of the war. On account of this expense and also on account of the mishaps which have occurred, following its use, he has substituted *Skirol*, a bismuth preparation, of the consistency of milk, which precipitates very slowly, so that there is very little possibility of any of the salt forming a base for a calculus. It is used clinically in a 10 per cent. solution and thus far has caused no renal irritation and seems to disappear from the pelvis of the kidney much more rapidly than collargol.

Technic of Nephrectomy for Tuberculosis. Surgeons are as one in the opinion that the proper treatment for tuberculosis of the kidney consists of nephrectomy as soon as the diagnosis is confirmed, provided that the opposite kidney is not involved. When, however, our attention is directed to a consideration of the management of the fatty capsule and the ureter in the performance of nephrectomy, one finds a great many different expressions of opinion, somewhat analogous to the unsettled and chaotic condition which the entire question of surgery of kidney tuberculosis was in ten years ago, so that one is justified in stating that the question of treatment of these two structures is not as definitely settled as are the questions of diagnosis and treatment. The most extensive work on the lymphatics of the kidney and its capsule has been done by Stahr who has shown that there are two capillary networks within the fatty capsule of the kidney, a coarser network which lies under the peritoneum superficial to the fatty capsule and a second capillary network which lies in the deeper layers of the fatty capsule, close to the kidney substance. This latter is a delicate network which is in direct communication with the lymph capillaries of the kidney cortex. Although the different lymphatics leave the kidney at the hilus, it has been demonstrated that a lymphatic connection exists between the lymphatics of the kidney and those of its fatty capsule. These anatomical facts are of much importance in a consideration of the treatment of the fatty capsule, since it is reasonable to expect that in all, or in the large majority of cases, the fatty capsule must sooner or later become infected, and, if this is so, we must consider the propriety of the removal of the fatty capsule as a routine procedure. For over three years Kretschmer² has made it a routine procedure to remove as much of the fatty capsule as possible after the kidney is removed. In cases in which there has been a good deal of perineph-

¹ Dublin Journal of Medical Sciences, 1916, vol. cxli, p. 166.

² Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 391.

ritis, with extensive thickening of the fatty capsule, so that extensive adhesions are present, rendering the removal dangerous, it may be necessary to forego its removal. Furthermore, the danger of injury to the peritoneum, with resulting tuberculous peritonitis, is obvious.

The management of the ureter has caused more discussion than perhaps any other phase of the subject, and it is the one which, up to the present time, has not been satisfactorily settled to all concerned. The many different ways of treating the ureter which have been advised is proof that the ideal method has not been obtained. At the present time, based upon past experience and results, by far the largest number of surgeons are practising less radical measures than formerly and merely perform a partial ureterectomy. Kretschmer has never attempted extensive resections of the ureter, being content to remove as much of the ureter as possible through the lumbar wound, usually being able to divide the ureter at the pelvic brim and occasionally just below it. He divides the ureter between heavy artery forceps, the cut end is treated with carbolic acid and tied with heavy catgut and then allowed to drop back into the wound. The usual objection to leaving a stump of the ureter has been that it continues to pour infectious material into the bladder, thereby infecting a clean bladder or delaying the healing of an already infected bladder. In answer to this objection, Kretschmer asks, "Who can say that a long stump is any more infectious than a short one?" He also quotes Albarran who made the decision as to whether a conservative or radical ureterectomy should be performed, after noting the ureteral findings. If the thickened ureter is increased in circumference because of a thickening of its walls, and if its lumen is small, he proceeds as usual in that he resects as much as can easily be resected, and these cases heal without fistula formation. If the ureter is very thick and the lumen, on cross-section, is dilated, then, and only then, should ureterectomy be performed as completely as possible, since in these cases the vesical end of the ureter is dilated and altered. This is the type in which the bladder urine flows up the ureter and into the lumbar wound.

Rapid Diagnosis of Renal Tuberculosis. In early tuberculosis of the kidney it is not infrequently impossible to make a positive diagnosis on the clinical appearances alone. In such cases it has been the custom for some years to bring to our aid the use of certain laboratory tests as confirmatory evidence. Chief among these tests, so far as accuracy is concerned, is what is known as the guinea-pig test, consisting of the injection of suspected material, usually urine, into a guinea-pig, killing the pig several weeks later and then subjecting the tissues of the animal to microscopic examination for evidence of tuberculosis. There is only one objection to the test as it has been performed and that is the long interval which must elapse between the time of injection and the time of examination of the animal's tissues. During the past year this test has been so modified by Morton¹ that this objectionable feature has been largely eliminated. A few years ago, Murphy and Ellis²

¹ Journal of Experimental Medicine, 1916, vol. xxiv, p. 419.

² Ibid., 1914, vol. xx, p. 397.

showed that white mice were made markedly more susceptible to bovine tuberculosis after being subjected to suitable x-ray exposures. Following in the wake of this experiment, Morton has found that it is possible to reduce the resistance of guinea-pigs to human tuberculosis by means of x-ray exposures, so that when animal inoculation is required for diagnosis, a much quicker result may be had than by the use of normal animals. Whereas ordinarily it requires from five to seven weeks before a diagnosis can be made, by the use of x-rayed guinea-pigs the result may be known in from eight to ten days, the lesions being so marked, even after such a short interval, that the diagnosis is certain. The resistance of the animal can be lowered sufficiently by one massive dose of x-rays administered either shortly before or after the inoculation of the material to be tested. The effect of the x-rays in lowering the resistance of animals to tuberculosis is probably due to the destruction of lymphoid tissue which constitutes an important agent in the defensive mechanism against tuberculosis.

Pedicle Clamp for Nephrectomy. In order to facilitate the application of a non-slipping ligature to the kidney pedicle, or in fact any pedicle, Lower¹ has devised a special clamp. As shown in the illustration, the clamp is made with wide blades which for nearly their entire length are divided into two unequal sections. It is this division which makes possible the application of a suture ligature in such a manner that the danger of slipping is obviated or minimized. The upper sections of the blades are wider than the lower and are grooved parallel with the blades which are thus prevented from slipping. The instrument is $9\frac{1}{4}$ inches long while the blades average $2\frac{1}{4}$ inches in length and are $\frac{5}{8}$ of an inch in width, the upper section being $\frac{3}{8}$ of an inch wide and the lower section and slit being each $\frac{1}{8}$ of an inch in width. The length of the slit is 2 inches. In a nephrectomy, after the pedicle is freed sufficiently, the forceps is applied and the pedicle divided as in Fig. 96, 1. No further attention need be given to the clamp during the removal of the kidney, as it cannot slip. After the ureter has been divided and the kidney removed, a figure-of-eight suture is applied through the slit, as in 2 and 3. As the ligature is tightened, the forceps is slowly loosened and removed by raising the heel as in 4. In this way a non-slipping ligature is applied and the avoidance of bleeding assured—a result not always secured by other clamps.

Renal Infection. In a most exhaustive study, indeed too extensive for critical review in these pages, concerning the etiology and pathology of non-tuberculous renal infections, Cabot and Crabtree² have attempted to show that the lesions produced in the kidney by pyogenic organisms differ in essential particulars, and are distinguishable from those produced by non-pyogenic organisms. A careful analysis of the pathological material that has come under their observation has demonstrated that the lesions produced by the pyogenic group of organisms consist of perinephritic abscess, capsular abscess, capsulitis, cortical abscess, septic infarct and diffuse suppuration. On the other hand, the lesions

¹ Cleveland Medical Journal, 1916, vol. xv, p. 244.

² Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 495.

produced by the colon-typhoid group of bacteria consist of acute pyelitis, acute pyelonephritis, chronic pyelonephritis and pyonephrosis. Infection of the kidney with both pyogenic and non-pyogenic organ-

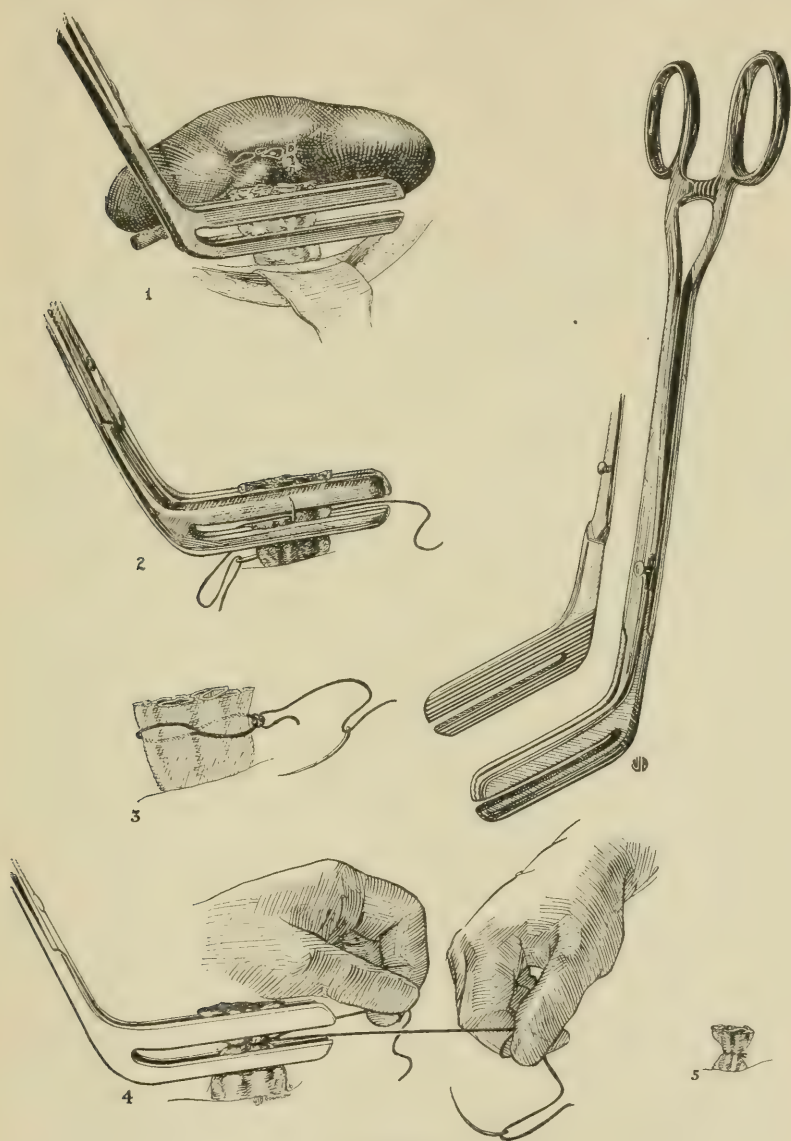


FIG. 96

isms will produce a mixture of the lesions characteristic of both groups. This latter fact probably explains the not uncommon, though false, belief that the colon bacillus will produce abscess of the kidney. This has been freely stated and appears to have been supported by the

evidence of cultures obtained from the kidney. Cabot and Crabtree, however, have shown this reasoning to be fallacious for two reasons: First, cultures containing both colon bacilli and cocci will frequently be interpreted as showing only colon bacilli, as this organism grows with great rapidity and readily obscures the colonies of cocci. Second, it has been assumed that the cultures obtained from one part of the kidney represented the lesions produced in the whole kidney. That this is fallacious has been shown by the actual demonstration of bacilli in one portion of the kidney, cocci in another, and cocci and bacilli associated in other portions. In these mixed infections, the colon bacillus probably precedes the coccus in point of time.

If these investigators have succeeded in establishing the fact that the pyogenic organisms produce lesions of the kidney essentially different from those produced by non-pyogenic organisms, it follows that this fact has an important bearing upon diagnosis. In the first place, it has been demonstrated by many observers that organisms concerned in renal infections appear promptly in the urine though they may not long continue to so appear, so that with clinical evidence suggesting a renal infection, the diagnostic importance of a careful examination of the urine can hardly be overestimated. Thus the lesions characteristic of pyogenic organisms will show the bacteria in the urine perhaps only in the early stages. Since, however, these lesions are comparatively shut off from the lower portions of the kidney and as they do not involve the pelvic mucous membrane, pus in any considerable amount will be found rarely, if at all. Further, since the lesions of the non-pyogenic group are produced chiefly in the renal pelvis, evidence of this fact is abundantly clear in the urine by the early production of pus accompanying the appearance of the microorganisms. A very striking difference is also to be observed in the effect on kidney function, as measured by phthalein, of these two types of infection. Since the suppurative infections involve chiefly the cortex and the convoluted tubules are comparatively slightly damaged, they would be expected to produce comparatively little effect upon kidney function thus measured and such is the case according to the findings of Cabot and Crabtree. On the contrary, the chief lesion of acute renal infections with the colon bacillus group is first upon the convoluted tubule, the pelvic lesion, although appearing early, is probably secondary to the tubular lesion. This should, and in fact does, produce sudden and profound changes in kidney function.

Briefly and somewhat dogmatically stated, the diagnostic evidence which has been elucidated by this study is as follows: If, with clinical evidence suggesting a renal infection, freshly drawn urine which is carefully studied shows cocci in abundance with a small amount of albumin, a few red blood corpuscles and many leukocytes or a little pus, together with a renal function at, or near, normal limits, a diagnosis of coccus infection of the kidney is justified. If, on the other hand, a similar examination shows many bacilli, a little albumin and much pus coupled with a markedly diminished kidney function, a diagnosis of colon bacillus infection of the kidney is unavoidable. In

considering the treatment of these two types of kidney infection, it is clearly seen that the suppurative lesions concern those portions of the kidney which are relatively inaccessible to drugs and if these lesions are such as to require treatment, that treatment must be operative. On the other hand, the lesions produced by the colon bacillus group concern those portions of the kidney relatively accessible to formaldehyde-containing drugs, and the surgeon is therefore justified in persisting in treatment by this method on the assumption that if it be properly planned, and efficiently carried out, it will succeed in controlling the infection.

Role of Lymphatics in Ascending Infection. Eisendrath and Kahn¹ have completed a series of 27 experiments on dogs and rabbits which show that infection travels from the bladder to the kidneys and perinephritic tissue by way of the lymphatics in the wall of the ureter and not along its mucous membrane. Furthermore, the constant finding of evidences of infection in the immediate vicinity of the rich network of periureteral bloodvessels makes it seem plausible that infection can travel to the kidneys from the female genitalia and other abdominal viscera which lie in close relation to the ureter. In their experimental work, these investigators have attempted to imitate the conditions as found in the human being by injecting an emulsion, made by mixing the scrapings of agar slant cultures of the organisms commonly found in urinary infections with sterile salt solution, into the bladder of the animal. After a thorough cleansing of the genitalia of a female animal, a No. 4 or 5 (French scale) ureteral catheter which has been boiled is inserted into the bladder, some of the urine taken for culture and then an emulsion of bacteria is injected into the bladder. All injury to the bladder and ureters is thus avoided, and the conditions under which the organisms migrate upward resemble those found clinically as closely as it is possible to do in animal experiments. In order to trace the infection upward along the ureter, every portion of the latter was cut longitudinally as well as serially, so that no areas would be omitted. In five rabbits and eight dogs, the *Bacillus coli* was injected into the bladder. In three rabbits and four dogs the *Staphylococcus aureus*, and in three rabbits and three dogs the *Proteus vulgaris*, was used. In one rabbit an emulsion made by mixing acute gonorrheal pus with salt solution was injected. The findings following such injections showed that in the early stages of infection, the infiltration is found in the submucous layer of the bladder and is especially dense around the smaller vessels in this layer. One can then follow the infiltration up into the ureter, where, as in the bladder, it is most marked in the submucous coat in the lowermost portion of the ureter. A little farther up, however, in addition to the submucous infiltration, a new factor is introduced, since the periureteral sheath, composed of loose areolar tissue in which many bloodvessels lie, plays an important, if not the chief, part in transmitting the infection upward. Examination of serial sections longitudinally of the entire ureter show plainly how in the early stages

¹ Journal of American Medical Association, 1916, vol. lxvi, p. 561.

the infiltration around and in the walls of the bloodvessels of the peri-ureteral sheath is the earliest and most constant finding. As the infection progresses, the other coats become invaded from without inward, the mucosa remaining intact, until the infection is well advanced. In the kidney pelvis, the infiltration is first seen in the subpelvic areolar tissue and again around the bloodvessels, the overlying mucosa remaining intact. Eisendrath and Kahn are convinced that there is a free communication between the lymphatics of the bladder and those of the ureter and that the lymph current is in an upward direction. Furthermore, they believe that their work shows that the connecting link between the lymphatics of the ureter and those of the kidney is along the lymphatics of the subpelvic areolar tissue which surrounds the bloodvessels as they enter the kidney tissue. In 6 out of 27 experiments, they obtained pure cultures of the same organism from the renal pelvis as they had injected into the bladder. In none of these animals was a positive culture obtained from the heart blood, so that hematogenous infection can be excluded.

Pelvic Lavage in Pyelitis. In selecting patients for treatment by pelvic lavage, it is well to bear in mind that many cases of pyelitis are associated with organic disease of the kidney, its pelvis or ureter, such as stone, stricture, dilatation and tuberculosis. This group requires appropriate surgical treatment and such cases are not considered favorable ones for pelvic lavage. Kretschmer and Gaarde¹ have presented their experiences and results in a series of cases of chronic colon bacillus pyelitis which were treated by pelvic lavage and call attention to the fact that when speaking of a cure, as a result of this mode of treatment, it is well for one to state just what is meant. They have not discharged as cured any patient who did not fulfil two requirements; First, the urine had to be free from pus, and second, cultures of the urine obtained by ureteral catheter had to be sterile. To free the urine of pus was a relatively easier task to accomplish than it was to obtain sterile cultures. Many times the urine would become free from pus and the clinical symptoms disappear following one or two treatments, but the cultures still showed the presence of the causative organism. It is evident that too much stress cannot be laid on this fact, and it is easy to understand why many cases relapse if the treatment is stopped before the cultures are sterile. The treatment, as carried out by Kretschmer and Gaarde, consisted of injecting from 5 to 10 c.c. of a 1 per cent. solution of silver nitrate every five or six days until the urine was sterile and free from pus. During the first week, after the diagnosis was made, the patients were given one teaspoonful of sodium bicarbonate three times a day so as to thoroughly alkalinize the urine. During the second week the soda was stopped and in its place acid sodium phosphate was administered, so as to thoroughly acidify the urine. During the second week, that is the week of acid urine, hexamethylenamine was given, varying in amounts from 30 to 70 grains a day. When the hexamethylenamine produced vesical symptoms, the amount was reduced. This

¹ Journal of American Medical Association, 1916, vol. lxvi, p. 2052.

form of internal treatment was continued during the alternate weeks, as long as the patient was under treatment. Of the 14 patients treated by the above method who were traced and followed, bacteriological cures were obtained in 11 cases. In the remaining 3, it was possible to obtain positive cultures from the ureters, although subjective symptoms and leukocytes in the urine had long since disappeared. The number of injections required varied. In 4 cases one injection was given; in 5 cases two injections; in 3 cases three injections; in 1 case, four, and in another, eight injections. The results obtained in this series leads these investigators to believe that pelvic lavage gives a greater number of bacteriological cures in a shorter space of time than any other form of treatment, but it is important that the urine be sterile in order to prevent recurrences. In several instances they obtained sterile urine after one or two treatments of patients who had been on internal treatment for many months.

Unilateral Symptomless Hematuria. In the consideration of the problem of unilateral symptomless hematuria, Payne and MacNider¹ strongly object to the use of the term "essential" when specifying the cause of this condition, since the use of such a term intimates the absence of all pathology in the faulty kidney. They do not recognize that such a negative condition can exist with a hematuria and believe that in every case of unilateral renal bleeding there occur definite changes in the kidney which act as the direct causative factor. Their studies have been confined to 11 human and 6 cases of experimental hematuria which they have succeeded in producing on the dog. In the first 8 human cases their findings seemed to coincide with those of other investigators, namely, nephritis, interstitial nephritis and glomerulonephritis. It is to be recorded, however, that nephrotomy was done in these cases and sections of the cortex only were studied. In the next case a nephrectomy was performed for the relief of this condition, and in that case they were able to demonstrate for the first time the actual source of the bleeding to be from dilated veins in the pyramids and on the free surface of the papillæ. Later, they had 2 more cases which showed the same pathological changes, namely, few, if any, changes in the cortex, a marked overgrowth of chronic inflammatory tissue in the medulla and pyramids which surrounded the vessels of this zone, and these vessels were dilated and resembled varicosities. In the cases of experimental nephropathy in the dog in which they succeeded in securing a condition of hemorrhage analogous to the clinical type under study, the same changes in the kidney were present. As a result of their experimental study, Payne and MacNider have learned to recognize two distinct types of bleeding resulting from infection: First, the early form of bleeding from acute inflammation with diapedesis, and second, a cessation of this hemorrhage with return of more or less constant bleeding when chronic inflammatory changes occurred in certain definite areas of the kidney.

The one great argument brought forth by many observers against nephritis being the cause of this condition is the comparatively large

¹ Journal of American Medical Association, 1916, vol. lxvii, p. 918.

number of chronic nephropathies which do not bleed. In reply to this well-taken point, these investigators state that in the ordinary severe types of chronic nephritis the bulk of the changes are in the cortex, whereas the changes found in the present study were located in the medulla and pyramids. Further, in their work with experimental nephropathies, they have so far found a bleeding kidney only in those cases in which the principal changes have occurred in the medulla and pyramids.

Renorenal Reflex. It is well known perhaps, that the symptom of pain arising from disease in one kidney may be referred entirely and completely to the opposite side, the latter organ being healthy, so far as we are able to ascertain by our present methods of examination. In the absence of any demonstrable lesion, either within or outside of the kidney, sufficient to account for such localization of symptoms, we are justified in assuming the pain to be reflex—renorenal reflex pain. The importance of this phenomenon, from the stand-point of diagnosis, is not as great as it once was, since errors in diagnosis are not so apt to occur from misleading subjective symptoms since the employment of more accurate means of examination, *x*-rays, cystoscopy, ureter catheterization and renal functional tests, have become more general. The occurrence of this phenomenon, however, emphasizes the importance of a thorough and complete pre-operative examination of every case of suspected renal calculus. Although these cases of renorenal reflex pain are rare, only a relatively small number of them having been reported in detail, the fact that they do occur is evidenced by a case that has been reported by Fowler.¹ In this case, a woman, twenty-nine years of age, was found suffering with what appeared to be typical renal colic and was lying in bed with a hot-water bag applied to the right loin. She was nauseated, and had vomited several times earlier in the morning. She described the pain as very sharp and severe, and was felt in the right loin just beneath the costal border and did not radiate down the ureter or in any other direction. Ten years previously she had had an attack of hematuria which came on without apparent cause, followed in a day or two by very severe kidney colic. Five years later she had a second, similar attack. The pain in the former attacks, as well as in the present one, had always been referred to the right kidney and there had never been any pain on the left side nor any vesical irritation. Palpation of the left kidney region elicited no tenderness, muscular rigidity, or pain, local or referred. The right kidney region was tender on palpation, painful and there was slight muscular rigidity. An *x*-ray examination showed a distinct shadow opposite the cartilage between the third and fourth lumbar vertebræ on the left side and in a line with the tips of the transverse processes. The right kidney and ureter, as well as the left kidney, were negative. Cystoscopy of the bladder was negative, and after passing a wax-tipped catheter into the left ureter it was slowly advanced until it met an obstruction at a point 24 cm. from the ureteral opening. The right ureter was easily catheterized to the kidney. Upon the foregoing evi-

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxii, p. 454.

dence, supplemented by the finding of albumin, renal cells and many leukocytes in the urine from the left kidney, the *left* kidney region was explored and a stone removed from the left ureter, although the symptoms had always pointed toward the right kidney as the diseased organ. The convalescence was satisfactory and without incident and there was no recurrence of the pain in the right side for nearly a year after operation (at the time of the report), and microscopic examination of the centrifuged urine was negative for red cells.

New Technic for Nephropexy. Having become somewhat discouraged with the results obtained in cases of prolapse of the kidney treated by means of the older methods of suspension, Bissell¹ has adopted a radical change in preparing the kidney for fixation, which consists essentially in exposing the greater part of the posterior surface of the organ and using the fibrous capsule to prevent the fat from wedging its way between the apposing surfaces. In this way he does not depend on the variable strength of the capsule, which in the past has caused him so many disappointments.

Technic. Having exposed the kidney in the usual manner, a crescentic incision of the fibrous capsule is now made. This incision begins practically on the convex surface near the upper pole, extends on the posterior surface of the kidney to within about one centimeter of the hilum, and continues to the convex surface near the lower pole. Two sustaining sutures of silkworm gut, kangaroo tendon or chromic gut are now passed completely around the kidney, one about the lower and one about the upper pole. They are passed in the following way: The one surrounding the lower pole penetrates first the free portion of the fibrous capsule near its juncture with the kidney and about one-half inch from the center of the convex border. In its course around the kidney, it penetrates the anterior surface of the fibrous capsule midway but only sufficiently to keep it in place. It is now passed around the inner or concave border close to the lower limits of the hilum, and then through the attached portions of the fibrous capsule remaining on the posterior surface. The suture encircling the upper portion is passed in like manner, and the ends of these sutures are clamped to keep them in position until the kidney is replaced. Three or more small catgut sutures penetrate the margin of the freed fibrous capsule. These are used, after the kidney is returned, to anchor this portion of the capsule to the under surface of the lumbar fascia. None of the fatty capsule except such as may remain attached to the lumbar muscular area is removed. As a rule, all of the fatty capsule is forced below and in front of the kidney when the organ is replaced, where it is retained by the anchored fibrous capsule. The inner ends of the sustaining sutures are now passed in the upper angle of the wound through the lumbar muscles, penetrating them well to the inner side of the last dorsal nerve and out through the skin. The outer ends are passed through the muscular tissue immediately below the twelfth rib and out through the skin. The several catgut sutures which are attached to the margin of the freed fibrous capsule are now anchored to the under

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 100.

surface of the lumbar fascia near its cut edges. The freed fibrous capsule, being thus anchored to the under surface of the fascia, acts like a shield to prevent the fat in the immediate region from being forced between the posterior surface of the kidney and the quadratus lumborum. The wound is then closed and the sustaining sutures at the upper angle of the wound are tied over a small roll of iodoform gauze, the lower suture being tied first so as to elevate the kidney as much as possible. If kangaroo tendon or chromic gut be used for the sustaining sutures, they can be brought out through the skin, or not, as desired by the operator. The skin sutures are removed on, or after, the twelfth day. The silkworm-gut sutures are cut on the inner side of the loop on the nineteenth day and the patient is allowed to get out of bed and sit on a chair. She is encouraged on the following day to walk around a bit and on the twenty-first day the silkworm-gut sutures are gently pulled upon, but, if they do not come away easily, force is not used but the patient is allowed to walk about for a few more days and then gentle traction is again made on the sutures. By means of this operation, the kidney area exposed for attachment is the most extensive surface available and so situated as to permit the kidney being anchored in normal anatomical relationship; the sustaining sutures encircling both poles insure immobility until firm union has taken place and their high placement in the tissues of the back insures a practically normal position of the organ.

Stricture of the Ureter. During the past few years, Hunner¹ has interested himself in the subject of ureteral stricture, taking into consideration only the narrowing of the ureteral lumen due to intrinsic disease of the ureter, thus excluding strictures due to tuberculous disease and those immediately surrounding a stone. He believes that by far the greatest source of ureteral stricture is some distant focus of disease, such as infected tonsils, sinuses, teeth or disease of the gastrointestinal tract. In such cases, the disease settles in the ureteral walls and causes the narrowing which in many cases is followed by dilatation, and, later, by infection of the urinary tract. The symptoms of ureteral stricture are, for the most part, due to the obstruction, and are identical with the symptoms of stone in the ureter. Some patients complain only of a more or less constant dull aching pain in the lumbar region; others have this constant dull pain with acute exacerbations of pain in the kidney region, often referred down the ureter, sometimes requiring morphine for relief. If infection be present, the symptoms are likely to be more severe and are accompanied by chills, high temperature and profound prostration. From a diagnostic stand-point, it is important to note that the urine may be quite negative in some cases, since too often with a negative x-ray picture and a negative urine it is concluded that the urinary tract is not involved, and renal catheterization and the obtaining of a pyelo-ureterogram are neglected. The patient is operated upon for appendicitis, or some form of exploratory laparotomy is done and the victim continues to suffer or to find partial relief in expectant methods of treatment. Hunner believes that the

¹ International Abst. Surgery, July, 1916, p. 87.

ideal treatment for stricture of the ureter is by dilatation from the vesical approach, since dilatation results in relieving the patient's symptoms and in a shrinkage of the distended pelvis and ureter. If infection be present, dilatation should be supplemented by renal lavage, although it is probable that many cases would clear up without the lavage on account of the free drainage established. In the infected cases of long duration, with immense sacculated kidneys, one may be unable to clear up the infection, but, after dilatation of the stricture, the kidney pelvis shrinks markedly, the urine becomes much more clear and the patient is restored to apparently normal health. In the cases with a large hydronephrosis or pyonephrosis, conservatism often calls for extirpation of the kidney. In cases that cannot be dilated from the vesical approach, Hunner advises extraperitoneal exposure of the ureter and retrograde dilatation. In a series of 50 cases, bilateral stricture was demonstrated 12 times. It is probable that systematic examination would have shown a larger percentage of bilateral cases, as some of these 12 had symptoms on one side only, and the other side was accidentally shown to have a stricture in the course of a functional test; or, after relief of symptoms on one side, the patient returned later with symptoms in the other kidney, and these were found to be due to stricture in the corresponding ureter.

Treatment of Bladder Tumors. There has been little change recorded in the literature of the past year in the methods of treating tumors of the urinary bladder, except perhaps, for an ever-increasing tendency to discard operative surgery and substitute electrocauterization in its place. Geraghty¹ states that the experience of the Brady Urological Institute in recent years clearly demonstrates that benign and malignant papillomata should be treated by fulguration; excision or resection should not be practised except where intravesical treatment is impossible or very difficult. Radium has been a great aid in treatment, particularly of the malignant papillomata and their best results have been obtained when the radium was placed directly against the tumor. When, however, the tumor is a papillary carcinoma, resection should be practised by a technic which will reduce to a minimum the dangers of implantation or recurrence since radium, as yet, has not given results in this type of tumor sufficiently encouraging to warrant its employment in preference to resection in cases which are considered operable.

Uhle and Mackinney² have analyzed the results of their experiences with the high-frequency destruction treatment of bladder tumors, which they have employed in 29 cases. In this series, a diagnosis of benign papilloma was made in 22 cases; of papillary carcinoma in 3, and carcinoma in 26. High-frequency destruction was employed in 19 of the benign papillomata, in 3 cases of papillary carcinomata and 7 cases of infiltrating carcinomata. The youngest patient with papilloma was 22 years of age, the oldest 67, the average being 47.2 years. The youngest patient with carcinoma was 36 years of age, the oldest 80, the average being 57 years. Of the 22 cases of papilloma, 19 were of the

¹ New York Medical Journal, 1916, vol. civ, p. 838.

² Pennsylvania Medical Journal, 1916, vol. xix, p. 423.

villous type, 3 were semisolid, non-villous and more sessile than pedunculated. With 3 exceptions, the monopolar Oudin current, generated from a Wappler coil, was employed and found perfectly satisfactory. The illumination was derived from a dry-cell battery and the spark from the circuit. Both copper and steel-wire electrodes were used without preference, although at the present time, they do not believe that perfectly satisfactory electrode has been made. The large, bone-tipped electrode has been discarded because of the occasional detachment of the bone tip, and the small insulated wire has been substituted because it can be applied through a small cystoscope, making the treatment more tolerable to the patient. They attempt to destroy as much of the tumor as possible at each treatment, the current being applied continuously and only being interrupted when the end of the electrode becomes fused. General anesthesia has not been found necessary, since a satisfactory local anesthesia can be obtained by the use of novocaine.

A clinical cure in this series was based upon freedom from symptoms, a clear urine, microscopically free from pus and blood, and the absence of any evidence of tumor by cystoscopic examination three months after the last treatment. Every patient was impressed with the possibility and danger of recurrences and advised to return at intervals of six months for cystoscopic examination. In 1 case a recurrence was observed at its former site four months after its apparent cure, but this responded at once to further treatment. In a second case, the patient returned with a papilloma at a different site after ten months of apparent health; the site of the former tumor being perfectly normal; a third patient returned at the end of nineteen months with hematuria and multiple small papillomata of the villous type at the apex of the bladder. Of the remaining 19 cases, 6 never returned for cystoscopic examination after a clinical cure had been obtained; whereas 13, including 1 case of recurrence, returned for cystoscopic examination over periods of from two to seventeen months and were in apparent health.

Diverticula of the Bladder. From January, 1908, to November, 1915, 27 cases of diverticulum of the urinary bladder have been observed in the Mayo Clinic, and this series has been studied and reported by Thomas.¹ Fourteen of these patients were operated upon, 7 were not operated upon and 6 cases were found at autopsy. The average age of these patients was 51 years, the youngest 18, the oldest 73; the average age at onset of symptoms was 43 years. Of these 27 patients, 6 gave a history of urethral infection and 2 had infection about the urethra associated with stricture. Five patients had had previous operations, 2 for prostatic obstruction, and 3 some operation on the bladder for drainage or exploration. Six patients gave a history of trauma of the bladder, suprapubic area or perineum. The trauma to the perineum in 2 cases was the cause of obstruction which preceded the symptoms. The 4 remaining patients gave good histories of onset of symptoms immediately following the trauma of the bladder. The urinary symp-

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 378.

toms presented by these patients are of interest. Difficulty of urination was present in 19 instances (70 per cent.) and was noted in 11 (40 per cent.) as the first symptom. In 9 there was retention, and catheterization had to be resorted to before urine could be passed. In 3 there was incontinence. Frequency of urination was the first symptom in 9 patients (33 per cent.) and was the predominant symptom in 22. Hematuria was the first sign observed by the patient in 2 instances (7 per cent.) while macroscopic blood was observed at some time during the history in 8 (29 per cent.). Although a history of *repeated* urination is a symptom which has frequently been noted in published reports, such a history was obtained from only 1 patient. Cystoscopic examinations were made in 19 cases; in 16 there was a marked degree of cystitis, while in 3 cases, cancer of the bladder was found. The Röntgen

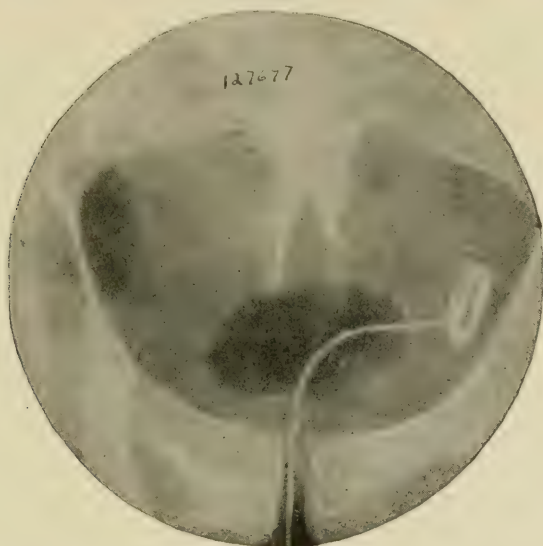


FIG. 97.—Shadow-casting catheter carefully coiled in a diverticulum in the left lateral wall of the bladder.

rays were employed in order to make a cystogram in 16 cases, 10 showing positive findings and it is the belief in the Mayo Clinic that a routine cystogram in suspected cases, in which there is difficulty of urination not otherwise diagnosed, either with or without the aid of cystoscope, will demonstrate a diverticulum in a large percentage of cases. Care must be taken in exposing the plates since many shadows of diverticula are missed when the radiogram is taken in the ordinary antero-posterior position. Exposures should be made with the tube at different angles so that the shadow of the sac is not superimposed on that of the bladder. A coiled shadow-casting catheter or bougie will definitely outline a sac when shadow-casting fluids cannot be used. Care must be taken in the introduction of catheters into these sacs, and overdistention from injected fluids must be avoided because perforation of the diverticulum might occur.

Treatment. The methods of treatment which have been recommended in dealing with diverticula of the bladder include incision through the vaginal wall and drainage, establishing a fistula by sewing the diverticulum to the skin, peritoneal drainage behind the bladder, peritoneal drainage of the bladder, forcible stretching of the orifice of the diverticulum, curettement of the mucous membrane of the diverticulum and suture of the latter without drainage, invagination of diverticulum and bladder, enlargement of the orifice of communication between the bladder and diverticulum or a new anastomosis, division of the walls of the bladder and diverticulum and suture of the cut walls, and, lastly, suprapubic drainage.

With such a variety of possibilities in surgical treatment, it is interesting to note the manner in which the 14 operative cases of this series were treated. In 6 cases the diverticulum was resected, the extra-peritoneal operation was done four times and the intraperitoneal method twice. A preliminary drainage was done in 2 cases preparatory to a resection. In 6 instances, a drainage operation only was done or the diverticular opening was enlarged. In 1 case a septum was removed, and in 1 a diverticulum was dissected loose and its opening enlarged so that the drainage was improved or complete. When resection of the diverticulum is possible, the mortality from the operation should be negative, and it was so in the cases in this series in which resection was performed. On the other hand, in complicated cases the mortality is high on account of renal and vesical infection.

Exstrophy of the Bladder. The cause of the congenital defect known as exstrophy of the bladder, occurring as it does, once in about 29,000 births, is best explained on a mechanical basis, according to Moorhead and Moorhead,¹ namely, an intra-uterine rupture of a completely formed bladder. The first stage of such a process is the closing of the urethra, causing retention of urine. The pubic bones, at this time scarcely cartilaginous, and still ununited are kept apart until they become hardened. At the same time the rectus muscles are kept apart, so that, little by little, by the intravesical pressure of the urine, the bladder presses against the abdominal wall and finally ruptures, and forms adhesions to the borders of the split. These surgeons have had two cases of this condition, in both of which the Maydl operation, consisting of transplanting the vesical trigon into the sigmoid, was performed. One of these cases is unique, in that it is the first instance recorded in the literature in which the patient was a mother, and therefore is worthy of detailed consideration. The patient was a woman, twenty-six years of age, who had borne two children, one of whom was living and well, aged four years. While her condition was pitiable before she became a mother, child-bearing, followed by prolapse of the uterus and vagina, added much to her woe. At the first operation, the cervix was amputated and the pelvic floor was repaired. At a second operation, three weeks later, catheters were inserted into the ureters, the exstrophied bladder was dissected subperitoneally to the requisite extent and wrapped in gauze. The peritoneal cavity was then opened

¹ Journal of American Medical Association, 1916, vol. lxvi, p. 409.

and the uterus amputated at the corporocervical junction, conserving the ovaries and tubes. The sigmoid was then delivered and an intestinal clamp applied. The bowel was incised in the long axis 3.5 cm. after which the bladder was brought in apposition with the sigmoid without tension and an anastomosis performed between these two structures. Following operation there was a moderate degree of shock, but the patient soon recovered from this and five weeks after operation she left the hospital well pleased with her condition. She was observed for ten months after operation, and was found to have a good functional result, retaining her urine for four hours during the day and having only slight discomfort during the night.

SYPHILIS.

It is surprising to note, that in spite of the fact that all physicians are aware of the omnipresence of syphilis, that although the literature has always been more or less replete with articles concerning syphilis as a constitutional disease and calling attention to its protean manifestations, nevertheless the subject of syphilis of the female generative organs has received very meager and scant attention until a year or two ago. It seems that all of the gynecologists became aware of this fact at about the same time, and perhaps conscience-stricken, tried to remedy the defect by pouring forth contributions. Be that as it may, the literature of the past year contains numerous excellent articles dealing entirely with syphilitic manifestations in the female genital organs and even if time and space permitted, it would be a most difficult task to properly review all of the available material. We shall merely attempt to emphasize the principal points brought forth in some of these papers, suggesting to the reader that it will be well worth the time to consult the original articles.

Gellhorn and Ehrenfest¹ presented the masterpiece of the year before the American Gynecological Society at its meeting in Washington in May, 1916. They state that at present it is impossible to estimate, even approximately, the full

Extent to which Syphilis Exists in the World. The latest statistics, which tend to show that 10 per cent. of the male population of the United States are affected, are probably far too conservative. Syphilis has always been assumed to be considerably more common among men than among women, but, as a result of careful investigation, this supposition cannot as yet be considered as conclusive. At any rate, syphilis is common enough in women as to constitute a gynecological problem in the widest sense. Not every disease in a syphilitic woman is syphilitic in nature, but syphilis, if present, will exert an influence of its own upon coexistent diseases. Moreover, latent syphilis prevails more in women than in men. Syphilis of the internal genitals in women presents a number of problems as yet unsolved, such as the question of infection from the spermatozoa, the possibility of differences in the strains of spirochetes which might have a predilection for one or the

¹ American Journal of Obstetrics, 1916, vol. lxxiii, p. 864.

other part of the female genital tract, and the question whether certain parts of the genitalia possess a sort of relative immunity. Concerning the histopathology of syphilis, the authors are convinced that, notwithstanding how interesting and important certain vascular changes are in the picture of syphilis, nevertheless they are not pathognostic, and in a given case a final diagnosis cannot be made from the histological picture alone without the history and the corresponding clinical findings of the case unless one succeeds in demonstrating the *Spirocheta pallida* in the tissue.

The Vagina. Primary chancres of the vagina are rare, probably because of certain histological and biological characteristics of the vagina. The typical sign of sclerosis of a mucous membrane, *i. e.*, parchment-like induration, persists, as a rule, only for a short time. Under ordinary circumstances, spontaneous restitution occurs after about two weeks. The absence of definite symptoms, such as pain or discharge, and the insignificance of any remaining scars probably result, in a number of instances, in failure or even inability to correctly diagnose this lesion. Secondary lesions of the vagina are very rare. They occur either in the form of macules or papules, the latter variety seem to be relatively more frequent. They have no symptomatology of their own and therefore are discovered only accidentally during an examination with the speculum. Likewise, tertiary luetic manifestations originate but very rarely in the vagina. When found there, they represent, as a rule, the continuation of a like condition which had started from the vulva, the uterus or adjoining organs. The isolated submucous gumma breaks down early and appears in the form of a more or less characteristic ulcer. The more destructive processes which eventually lead to the formation of fistulæ and strictures, almost always originate in structures surrounding the vagina. Tertiary lesions do not exhibit characteristic symptoms, such as pain and discharge.

The Cervix Uteri. The primary chancre of the cervix represents the best known and most common type of syphilitic affection of the female internal genitalia, although its frequency has probably been overestimated. Statistics based on a large number of observations have never shown a frequency over 1.5 per cent. of all primary chancres found on the genitalia, although it must be admitted that in a considerable number of cases its presence on the vaginal portion of the cervix is overlooked. Chancre of the cervix does not give rise to any clinical symptoms, therefore, as a rule, a search for it is made only after the appearance of the secondary exanthemata. Under normal conditions, the primary lesion heals with such rapidity that its existence in a large percentage of cases can only be surmised from certain findings which in themselves are not characteristic. Not even during its existence does the primary chancre offer a truly characteristic and pathognostic aspect on account of its rapid and variegated evolution from an uneroded induration to an ulcer, which, in turn, either heals quickly or transforms into an inconspicuous erosion. Considering the absence of palpable satellite buboes, and the difficulty of ascertaining the characteristic induration at its base, a suspicious-looking sore on the cervix can be

identified as a primary hard chancre only if the *Spirocheta pallida* can be recovered from its surface and if the cervical lesion in due time is followed by a typical secondary exanthema.

Gellhorn and Ehrenfest have added 8 personal observations to the few cases of secondary lesions of the cervix which are to be found in the literature. Syphilis manifests itself upon the cervix in the form of macules, papules and ulcerations, which probably represent three successive stages in the development of a lesion caused by scattered accumulations of spirochetes in the squamous mucosa of the cervix. The parasite can readily be recovered from any of the three forms, which explains the great infectiousness of secondary lesions. The Wassermann reaction is positive in this stage. The leukoplasic appearance of the macules, the characteristic form of the papules and the typical yellow color of the ulcerations render diagnosis comparatively easy, while secondary lesions in other parts of the body form a valuable aid. Cervical lesions heal quickly and may disappear without leaving any traces, especially if specific treatment is given. A fairly large number of tertiary lesions of the cervix has been recorded in literature. The essential form is that of a gumma which usually undergoes necrosis and ulceration. If the tissue proliferation predominates, it is called gumma; if retrogressive changes prevail, we speak of tertiary or gummous ulcer. The consistency of the lesion is firm but becomes soft under the influence of tissue necrosis, and the color of the lesion is characteristically yellow. Bleeding or profuse mucopurulent discharge is present in most cases, but no pain. These lesions, which may heal spontaneously with the formation of scar tissue, disappear very quickly when specific treatment is instituted, while local treatment is altogether useless.

The Uterus. Our actual knowledge concerning syphilitic lesions of the uterine body is extremely meager, since primary and secondary manifestations have not yet been observed in the uterus. A few instances of gumma in the uterine wall have been recorded and there is also an isolated observation of gummatous change in the endometrium. This infrequency of tertiary lesions is a matter of surprise, for the uterus more than any other internal organ of the body is exposed to direct infection. Unless syphilitic lesions of the uterus have been overlooked in the past, there is probably a relative immunity on the part of the uterus.

The Adnexa. It seems possible that the tubes may be the seat of luetic lesions, but the pathological and clinical material on record is yet too incomplete to permit of positive assertions. Spirochetes have never been found in the tubes of syphilitic women. Various changes in the ovaries (simple enlargement, syphilitic oöphoritis, tertiary sclerosis of the ovary, ovarian gumma) have been described as typical expressions of the secondary and tertiary stages of luetic infection, but in practically no instance has positive proof been furnished that such alterations are actually due to a local luetic process. The fact that in some syphilitic patients either an amenorrhea, or, more commonly, a metrorrhagia disappears after specific medication cannot be accepted as evidence of a syphilitic ovarian lesion. Spirochetes have as yet not been demonstrated in the ovaries of adults.

Syphilis of the pelvic cellular tissue appears in the form of a diffuse gummatous infiltration which secondarily involves the pelvic peritoneum and in almost all cases recorded, a wrong diagnosis of malignancy has been made. Specific treatment produces amazingly quick improvement of an apparently hopeless condition.

Metrorrhagia. Syphilis may be the causative factor of disturbed menstrual function for various reasons. Impairment of general health, and disorder in the harmonious synergism of all endocrine glands through the affection of one, may, in the course of a luetic infection, interfere with normal ovarian activity. Therefore, in syphilitic patients, specific medication may correct a menorrhagia or metrorrhagia which has proved refractory to the customary modes of treatment. Such prompt therapeutic effect, however, does not permit of a diagnosis of luetic processes in the uterus or ovaries, because uterine lesions probably never, and syphilitic ovarian lesions, if actually existing, are but rarely responsible for abnormal uterine hemorrhages. Gellhorn and Ehrenfest believe that syphilis, by the infection of the entire organism, produces in some cases, directly or indirectly, *disturbances in the function but not the tissue of the ovary* and that these ovarian disturbances cause menstrual disturbances in the form of hemorrhages. They are also thoroughly in accord with those writers who recommend a trial with specific therapy before radical treatment is decided upon for all cases in which a uterine hemorrhage is not definitely explained by local findings.

Syphilitic Fever in Gynecological Practice. A review of his private cases and clinical experience, together with an analysis of the existing literature have convinced Taussig¹ that syphilitic fever is not such a unique symptom, if only we would be on the watch constantly to analyze the possible factors in the cases of unexplainable fever that we so frequently observe. Scientific proof of syphilitic fever in any case would require the exclusion of all other possible causes, the finding of spirochetes in the blood before treatment, and the simultaneous disappearance of spirochetes and fever under the customary treatment. Syphilitic fever may be divided into: (a) secondary syphilitic fever; (b) late secondary syphilitic fever; (c) tertiary syphilitic fever. Secondary syphilitic fever is that which we find preceding or coincident with the outbreak of the syphilitic rash and which occurs in about 20 per cent. of all syphilitics. Late secondary syphilitic fever occurs late in the secondary stage, offers greater diagnostic difficulties and is less frequent than that coincident with the eruption, and the temperature is occasionally higher and more persistent. Tertiary syphilitic fever is practically never due to syphilitic lesions in the female genital tract. It is much less frequent than the secondary types, but is of greater diagnostic importance. The fever is usually continuous and rises to 102° or 103°. Evidences of the syphilitic infection are usually absent, and the symptoms have been forgotten by the patient, so that the diagnosis is established with great difficulty and usually after considerable delay. The cause of syphilitic fever has been the subject of considerable debate; some insist that we must explain it on the basis of a secondary infection with

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 274.

other bacteria, but the majority feel that the evidence at hand justifies positively the conclusion that the fever is due to the spirochetæ and their toxins.

Frequency of Syphilis. That the history is often misleading and not to be relied upon in cases of syphilis may be seen from the investigations of Peterson¹ who had a Wassermann test performed upon 390 gynecological patients in the Obstetrical and Gynecological Clinic of the University of Michigan. Out of this number, 22, or 5.6 per cent., gave positive reactions, but in only 5 of the 22 luetic patients was there a history of syphilis. Hence the importance of such examinations, or a serious general disease will be overlooked and the gynecological patient will remain uncured.

Further work in this direction has been done by Williams and Kolmer² who performed a Wassermann test upon the blood of 300 patients, representing the types that might be met in the average gynecological dispensary and ward service, no selection being made as to the type of lesion present. All of the tests were conducted with the use of three antigens, namely, cholesterinized alcoholic extract of human heart, alcoholic extract of syphilitic liver and extract of acetone-insoluble lipoids from beef heart. Positive reactions were obtained in 22.6 per cent. of the cases, but of particular interest is the relatively high percentage of positive reactions observed in the following conditions: Stillbirths, 75 per cent.; rectal diseases, 50 per cent.; amenorrhea, 50 per cent.; habitual abortion, 50 per cent.; pelvic inflammatory disease, 36 per cent.; sterility, 33 per cent.; abortion and miscarriage, 29 per cent.; metrorrhagia, 20 per cent.; myomata of the uterus, 16 per cent.; gonorrheal vaginitis, 10 per cent.; pregnancy, 17 per cent.

The social condition has played no part in increasing the percentage of positive reactions in this series; some of the single women were parous, and a number of the married women were sterile. Race, however, seems to be a more important factor, since 35.8 per cent. of the black race gave positive reactions as compared with 20.2 per cent. in the white women. The history of infection has been obtained in but a few women; this is not due to the intention of the patient to deceive, but the well-known fact that the primary lesion in women is overlooked and the secondary stage may have been disregarded. The high degree of latent syphilis in women should make a routine Wassermann test in gynecological practice as advisable as any other routine procedure, since this test, under proper conditions, has proved highly specific and an indispensable diagnostic aid. Particularly during the child-bearing period should treatment be given; even in latent syphilis, where no symptoms are manifest it should be given, as according to our present knowledge, a persistently positive Wassermann reaction indicates the presence of living spirochetes in the tissues. Finally, Williams and Kolmer believe that while a particular lesion may not be syphilitic, it is highly important to institute antisyphilitic treatment if syphilis is demonstrated by the Wassermann test.

¹ Surgery, Gynecology and Obstetrics, 1916, vol. xxiii, p. 280.

² American Journal of Obstetrics, 1916, vol. lxxiv, p. 638.

DISEASES OF THE BLOOD, DIATHETIC AND METABOLIC DISEASES, DISEASES OF THE THYROID GLAND, SPLEEN, NUTRITION AND THE LYMPHATIC SYSTEM.

By ALFRED STENGEL, M.D.

THE BLOOD.

The Blood Cells and Hemoglobin. The work of Stockard¹ as to the ORIGIN OF BLOOD AND VASCULAR EPITHELIUM has been previously mentioned in these columns. Red blood corpuscles are always produced so as to be delivered into the vessels, and thus occupy an early intravascular position, while the white blood cells arise and remain for some time among the mesenchymal tissue cells in an extravascular position. Stockard concluded that vascular endothelium, erythrocytes and leukocytes, although all arising from mesenchyme, are really polyphyletic in origin, that is, each has a different mesenchymal fundament or anlage, and if one be destroyed the others are powerless to replace its product.

Danchakoff,² on the other hand, attempts to show an equivalence of different hematopoietic anlagen, and argues for a monophyletic origin of the blood cells. The grafting of adult splenic tissue on the allantois of chick embryos produced marked hyperplasia in the various hematopoietic tissues of the embryo, particularly the spleen. The type of proliferative reaction in the spleen varied greatly with the time and degree of development of the spleen when stimulated. In an early stage, when the spleen anlage still consists of a mesenchymal syncytium, stimulation produces an intense development of lymphoid hemocytoblasts, many of them showing a beginning differentiation into granulocytoblasts. At a later stage, when vascularization has begun, stimulation produces an intense erythropoiesis. If there are deficiencies in the development of the vascularization, there results a fibroblastic differentiation.

While it is impossible to deny that such a various differentiation might result under different conditions from isomorphic but heteropotential cells, yet the author thinks it more probably due to the polyvalency of a group of stem cells of the mesenchymal spleen anlage, these stem cells under different conditions splitting off variously differentiated products. To the stimulation of such primary stem cells under appropriate conditions she attributes the pathological myeloid metaplasias that have been observed in the spleen.

¹ American Journal of Anatomy, 1915, xviii.

² Ibid., 1916, xx, 255.

Jordan,¹ on the basis of histological studies of erythropoiesis in the yolk-sac of pig embryos, reached similar conclusions. Mesothelium of the yolk-sac plays no part in the production of hemoblasts. Mesenchyma, on the other hand, may differentiate directly into endothelium or into hemoblasts.

Rous and Turner² describe a METHOD FOR THE PRESERVATION OF LIVING RED BLOOD CELLS, in a state which the authors suggest might be termed one of suspended animation. The sugars, especially dextrose and saccharose, were found to have a remarkable preservative effect on erythrocytes suspended in salt solution or Locke's solution, or in citrated whole blood. The simplest way to preserve human erythrocytes is in citrated whole blood to which sugar solution is added, the proportions of the mixture being whole blood 3 parts, isotonic citrate solution (3.8 per cent. sodium citrate in water) 2 parts, and 5 parts of isotonic dextrose solution (5.4 per cent. dextrose in water). In such a mixture the red cells remain intact for about four weeks, and go easily into a suspension free of clumps.

If red cells are to be subjected to much handling, as in washing with the centrifuge, it is necessary to protect them from mechanical injury. Gelatin (0.125 per cent.) was found to possess a protective property under these circumstances. In this connection the authors object to the prevalent loose use of the term "fragility" as pertaining to resistance of erythrocytes to hypotonic salt solutions, it being strictly applicable only in regard to resistance to mechanical injury, as in shaking.

In order to determine the availability for functional uses of red cells kept *in vitro* by these methods, transfusion experiments were carried out in rabbits, a large part of their blood being removed and replaced by kept rabbit cells suspended in Locke solution. It was found that cells preserved in mixtures of blood, sodium citrate, saccharose and water for fourteen days, remained in circulation and function so well that the animals showed no disturbance, and the blood count, hemoglobin and percentage of reticulated cells did not vary. If kept longer, these cells rapidly disappeared from the circulation, as evidenced by increasing anemia together with a rise in reticulated cells. These animals did not, however, show any signs of hemolysis, such as bile or blood in the urine, and seemed to be free of symptoms. The authors suggest the availability of this method for use in man, the usual tests for iso-agglutinins and hemolysins having been performed.

Epstein³ describes a simplified HEMATOCRIT. The apparatus consists of small glass tubes made from selected glass tubing of uniform bore, and drawn out at one end into a fine capillary tip. The wide end of the tube is first dipped into powdered hirudin and then applied to the freely bleeding pricked finger or ear lobe. The tube is half-filled, then tilted two or three times to permit the hirudin to mix with the blood and prevent coagulation; then the blood is allowed to run down to about 1 centimeter from the capillary end which is now sealed in a flame.

¹ American Journal of Anatomy, 1916, xix, 277.

² Journal of Experimental Medicine, 1916, xxiii, 219, 239.

³ Journal of Laboratory and Clinical Medicine, 1916, i, 610.

The column of blood is now carefully measured on a millimeter scale. The tube is inserted by the sealed tip into a cork, centrifuged at a rate of 2500 revolutions per minute and the resulting column of supernatant plasma measured on a millimeter scale. Volume percentage of cells and plasma of the whole blood may thus be derived.

Williamson¹ has studied THE INFLUENCE OF AGE AND SEX ON HEMOGLOBIN BY SPECTROPHOTOMETRIC ANALYSIS OF THE BLOOD of 919 cases. Great care was exercised in the selection of material that the individual examined was in reality normal, since the concentration of hemoglobin may vary to a considerable degree in persons who regard themselves as perfectly normal. However, no attempt was made at any special selection, individuals remarkable for their strength or physical development being chosen only as they happened to fall naturally within the scope of observations. Also observations were fairly evenly distributed among all walks of life. Persons who had recently had any sickness, who were evidently in poor nutrition, or felt below par in any way, were not examined. Only such babies and children were taken as were evidently thriving.

The following table summarizes the results:

Age.	Grams of hemoglobin per 100 c.c. of blood.		Number of cases.	
	Male.	Female.	Male.	Female.
1 day	23.31	23.19	16	15
2 to 3 days	22.50	23.05	15	16
4 to 8 days	22.14	22.11	15	18
9 to 13 days	21.36	21.33	15	15
2 weeks to 2 months	18.70	18.04	15	15
3 to 5 months	13.08	14.25	16	16
6 to 11 months	13.22	14.19	18	15
1 year	12.80	12.23	18	16
2 years	12.44	12.70	16	17
3 "	13.21	13.11	15	16
4 "	13.28	13.98	16	15
5 "	13.83	13.27	17	18
6 to 10 "	14.57	13.70	18	15
11 to 15 "	14.48	14.87	17	20
16 to 20 "	16.81	15.64	16	15
21 to 25 "	17.23	15.03	17	21
26 to 30 "	16.41	15.53	19	28
31 to 35 "	16.94	15.44	16	16
36 to 40 "	16.98	15.36	17	15
41 to 45 "	16.85	15.64	15	16
46 to 50 "	17.07	15.49	22	15
51 to 55 "	16.96	16.08	19	16
56 to 60 "	16.97	15.78	15	15
61 to 65 "	16.46	15.71	15	16
66 to 70 "	16.19	15.51	17	15
71 to 75 "	15.22	15.46	19	17
76 and over	15.67	15.04	30	23
			464	455

By far the highest values are attained at birth. Beginning immediately, there is a very rapid decline. The minimum is reached during the second year of life. There is then again a gradual rise up to the sixteenth year, and from the sixteenth to the fifty-fifth year, variations

¹ Archives of Internal Medicine, 1916, xviii, 505.

are very slight. From the fifty-fifth year to the seventy-fifth year there is a steady decline.

Variations due to sex are negligible up to the sixteenth year. On the other hand, from the sixteenth to the seventieth year values for women are in every instance lower than those for men. It will be noted that the difference still exists after the cessation of menstruation.

In view of these facts, Williamson recommends that hemoglobinometers be standardized in absolute terms, most conveniently in grams of hemoglobin per 100 c.c. of blood, and such standardization of hemoglobinometers should be controlled spectrophotometrically. Whether or not a given blood contains a normal amount of hemoglobin can be determined only by a comparison of the absolute value obtained by a hemoglobinometer thus standardized with the normal value for that age and sex.

Küttner¹ presents A MODIFICATION OF THE SAHLI HEMOGLOBINOMETER. He substitutes for the standard hematin solution of the original instrument a solution of inorganic salts that is more stable and less likely to fade, and is suitable for either artificial or daylight. As there are wide variations in the hemoglobin-content of the blood at different ages and in the sexes, it is advisable that a standard be used whose terms in percentage are readily convertible into absolute figures. Therefore, Küttner uses a solution of such a color intensity as to correspond at 100 per cent. to 15 grams of hemoglobin per 100 c.c. of blood. To convert, therefore, any given percentage into terms of absolute hemoglobin value it is simply necessary to multiply by 0.15. Thus, 80 per cent. on Küttner's scale would correspond to $80 \times 0.15 = 12$ gm. of hemoglobin per 100 c.c. This is a distinct improvement on the Sahli scale, in which a reading of 100 per cent. corresponds to 17.3 gm., the top normal hemoglobin content observed by him in his assistants. Two pipets are used, one being the ordinary Sahli pipet, but graduated in divisions of 5 c.mm. each, the second pipet having five times the capacity of the first, but graduated in divisions of 10 c.mm. each, thus permitting of great accuracy of determinations in cases of severe anemia or polycythemia. To facilitate readings the author uses his microcolorimeter, previously described,² in which, by means of a prism, there is produced the optical effect of bringing the two observation fields in close proximity.

Hässler and Newcomer³ have devised a modification of the Sahli hemoglobinometer that aims to obviate a disadvantage of the original instrument, namely, the inability to reconsider a discarded choice. To accomplish this, they use a series of tubes in a rack, the tubes containing solutions of hematin hydrochloride in dilutions corresponding to 17.2 gm. of hemoglobin per 10,000 c.c. of fluid for the 100 per cent. tube, and the appropriate fractions for the other tubes, varying by 10 from 10 per cent to 110 per cent.

Patient's blood in a dilution of 1 to 100, as obtained by an ordinary

¹ Journal of American Medical Association, 1916, lxvi, 1370.

² Ibid., 1915, lxx, 245.

³ Archives of Internal Medicine, 1916, xvii, 806.

red blood pipet using tenth-normal hydrochloric acid as the diluent, is placed into the comparison tube. The comparison tube in turn can be slipped into the rack between the standard tubes, and by matching of colors a reading satisfactory for all clinical purposes obtained.

Meredith¹ offers a novel THEORY OF THE FUNCTION OF THE LYMPHOCYTES. The leukocyte (myelogenous cell) has as its function phagocytosis, it being capable of taking up and digesting bacteria and other foreign material, and it also has the function of excreting a proteolytic enzyme that is capable of dissolving dead tissue.

On the other hand, the lymphocyte takes part in the regeneration of the cells of the body: it is the male cell that is responsible for every true caryokinetic change that takes place within the body, as, for example, in normal repair. Thus in the liver a cell dies. Enzymes liberated by the dissolution of the dead cell attract leukocytes and lymphocytes, the one to remove the dead tissue, the other to repair. The same enzymes act on the adjoining cell, which swells and gets ready, as it were, for the male element furnished by the lymphocyte—probably in the nature of an enzymic substance—and impregnation, so to speak, ensues and caryokinesis results, with proliferation and replacement of the dead cell.

To support this belief, the author cites the invariable presence of lymphocytes in all inflammatory and regenerative processes, Carel's success in growing tissue cells *in vitro* in the presence of plasma, and Smith's success in the same endeavor when extract of splenic pulp was used.

In view of the uncertainty about the genetic relations of the various mononuclear wandering cells of the tissues and the large mononuclear cells of the blood, and the difficulty of definitely establishing such relations by methods so far available, Evans² proposes a CLASSIFICATION OF THE ADULT CELLS OF THE MATURE ORGANISM, BASED ON THE ABILITY OF THESE CELLS TO TAKE THE VITAL STAIN AND TO GIVE A POSITIVE OXYDASE REACTION.

In his experiments, Evans used lithium carmine solution, as advised by Kiyono,³ as the vital stain. For the demonstration of oxydase ferment, the indophenol-blue⁴ reaction was employed. He made the following observations:

I. Cells capable of specific vital staining by lithium carmine, the histogenous macrophages (Evans does not question the generally accepted view that all cells capable of vital staining are histogenous), contain no oxydase ferment; and, conversely, the oxydase-containing cells, the polymorphonuclears and transitionals are not specifically stained, *intra vitam*, by lithium carmine.

II. No normal circulating blood cell, either after acute or chronic staining of the animal with filtered lithium carmine solution by the intravenous or intraperitoneal route, takes the carmine stain, nor are the vitally staining histogenous macrophages ever encountered normally

¹ Medical Record, 1916, lxxxix, 1046.

² Archiv of Internal Medicine, 1916, xviii, 692.

³ Die vitale Karminspeicherung, Jena, Gustav Fischer, 1914.

⁴ Evans, F. A.: Proceedings of New York Pathological Society, 1915, xv, 143.

in the peripheral circulation, and only very rarely in the blood of the portal system.

III. In the tissues, in addition to accidentally occurring oxydase cells and the vitally staining histogenous macrophages normally present, there may be seen mononuclear wandering cells that contain no oxydase ferment and do not take the vital stain or phagocytize undissolved particles of it.

IV. In the splenic pulp are polymorphonuclear, oxydase mononuclear (transitional), non-oxydase mononuclear and vitally staining cells. The first three types are active wandering cells. The last does not migrate so actively, survives a relatively long time in tissue culture preparations, and takes part in the formation of foreign body giant cells.

To classify all the mononuclear wandering and blood cells that have been described in the literature according to the above indicated standards is manifestly impossible. Some may, however, be grouped as follows:

1. Cells containing an oxydase ferment and not taking the vital stains: the polymorphonuclear and oxydase mononuclear cells—this last name Evans suggests as more proper than the term transitional—myelogenous elements.

2. Cells containing no oxydase ferment, and specifically stained *intra vitam*. These cells are intimately associated with the fixed tissue elements and have been variously termed histocytes (Aschoff, Pappenheim, Marchand), pyrrhol cells (Goldman), and Macrophages (Evans). They are normal constituents of the tissues, occurring only rarely and accidentally in the peripheral blood, presenting diverse forms in the tissues that are to be differentiated from the next group only by reason of their vital staining.

3. Cells containing no oxydase ferment and not taking the vital stain—the lymphoid elements. To this group belong the true lymphocytes and probably most of the non-oxydase large mononuclears of the blood (Pappenheim's monocytes); and in the tissues, the plasma cell of Unna, the polyblasts of Maximow and the cell of small round-cell infiltration.

Evans¹ presents some observations on the origin and status of the so-called transitional cell. Probably the status of no white cell of the blood is so uncertain as that of this cell. Since the original, now discarded, hypothesis of Ehrlich that this cell was a transition form between the large mononuclear and the polymorphonuclear, it has been variously considered as an intermediate stage between the myelocyte and the polymorphonuclear neutrophile, as a senile form of the large mononuclear, as a promyelocyte, together with large mononuclears as an independent cell type of myeloid origin. As an independent cell type it has also been assigned to the lymphoid system, as coming from the splenic pulp and marrow cord cells of the lymph nodes; it has also been considered as of endothelial origin.

Evans bases his studies on a case of secondary lues in a patient, aged twenty-nine years, in whom after the administration of two doses of

¹ Archives of Internal Medicine, 1916, xvii, 1.

neosalvarsan there resulted an extraordinary mononuclear reaction. On admission, a leukocyte count of 9000 showed a differential of 62.3 per cent. polymorphonuclears, 28.6 per cent. myelocytes, 8.4 per cent. lymphocytes, and 0.8 per cent. transitionals. Ten days after the second dose of salvarsan there was observed a sharp rise of transitional cells with a striking drop of the polymorphonuclears (6700 white blood cells, 38 per cent. neutrophils, 40 per cent. transitionals). Twelve days later, coincident with signs of pericarditis, there was a leukocytosis, with polymorphonuclear increase, but with only a slight influence on the number of transitionals (18,280 white blood cells, 60.4 per cent. neutrophils, 27.2 per cent. transitionals). On the subsidence of the pericardial process there was a precipitate descent of the polymorphonuclear curve, while the transitional curve seemed quite uninfluenced and declined only gradually, reaching normal after nineteen days. During the polymorphonuclear reaction, myelocytes were present up to 4 per cent. of 18,280 cells, but at no time were myeloblasts observed. At the end the blood was flooded with fragile forms incapable of being classified (up to 54 per cent. of 21,600 cells) which seemed to be largely at the expense of the polymorphonuclears. The lymphocytes, through both the reaction of the transitional and polymorphonuclear elements, showed only the variations normally to be expected and these variations were entirely independent of the other reactions. Likewise, the composite group of cells classed as large mononuclears did not vary materially or in any relation to neutrophile or transitional reactions. The transitional cells, in contrast to those of lymphoid and endothelial origin, and in common with those of known myeloid origin, contained oxydase granules in great abundance. There were no transitional stages between any lymphocyte, large or small and the transitional cell.

Evans concludes that the transitional cell is not an immature or degenerate form of any other cell type, but is an independent cell type in itself, with a productive center closely related to but independent of that of the polymorphonuclear system, and capable of specific stimulation; that the transitional is not an endothelial cell, bears no relation to lymphocytes and is probably myeloid in origin; that the one type of large mononuclear closely resembling the transitional should probably be included with it to form an independent cell type; but if there is any difference in the age of the cells of oval or indented nuclei, the cell with the indented nucleus—the typical transitional—should be considered the younger.

Grüner,¹ on the basis of detailed morphological studies of the leukocytes stained by Pappenheim's panoptic stain in health and disease, with particular reference to malignant disease, reached the conclusions that cell findings in the blood smear vary in health under the influence of diet. The findings in malignant disease vary as the mass is actively growing or not (no discharge of specific excretion into the juices), and according to the gross mechanical effects of the neoplasm on the body (starvation, hemorrhage). Monocytosis is frequently seen in the proto-

¹ British Journal of Surgery, 1916, iii, 506.

zoan infections. It is also marked in some cases of carcinoma, and in many cases of sarcoma.

Since one phase of the blood picture produced by the circulating toxins of malignant disease can be imitated by ingestion of highly nitrogenous food, Grüner suggests that long-continued overuse of the same may form an advantageous substratum for the subsequent development of the disease.

If a smear shows neutrophilia and fat drops in many of the neutrophils, if the nuclei of the neutrophils are multifold, the case is one of a coccal infection of great severity. If the smear shows a relative increase of lymphocytes, especially the very small ones, and in the absence of leukocytosis, and if the multifold nuclei preponderate, the case is not one of malignant disease. If, however, there is neutrophilia, with bizarre forms or pseudopods in number, if the lymphocytes show in many instances ameboid outlines; if the monocytes show ameboid nuclei, the case is almost certainly one of malignant disease.

AN IMPROVED METHOD FOR THE DEMONSTRATION OF OXYDASE GRANULES IN THE MYELOCYTE SERIES OF CELLS is described by Graham.¹ Blood smears are treated as follows: After drying thoroughly in air the smear is fixed for one or two minutes in a mixture of 9 parts of 95 per cent. alcohol and 1 part of formaldehyde solution (40 per cent. of the gas). This mixture must be freshly prepared. After washing in water, flood with the following alphanaphthol solution; alphanaphthol (Merck) 1 gm., 40 per cent. alcohol, 100 c.c. hydrogen peroxide 0.2 c.c., allowing a reaction time of four or five minutes. Wash and place in a dish of running water for about fifteen minutes. Then stain two minutes with the following solution: Pyronin, 1 gm.; aniline, 4 c.c.; 40 per cent. alcohol, 96 c.c. Dissolve the pyronin in the alcohol and add the aniline. These solutions keep well. Wash in water. Stain one-half or one minute with 0.5 per cent. aqueous solution of methylene blue (Grübler's B.X.). Wash in water; blot. Mount in a neutral balsam. Acid balsam may be neutralized by adding dried sodium carbonate to a thin solution.

The resulting picture is much like that obtained after Romanowsky stains, excepting for the greater prominence of the granules. Best results are secured with fresh smears, or smears not over a few days old.

Tissues must be formalin-fixed, and freshly cut frozen sections must be used. Stain lightly in a not too acid alum hematoxylin. Wash in water, then for five minutes in a saturated aqueous solution of lithium carbonate, return to water for a few minutes. Then stain ten minutes in a mixture, prepared immediately before use, made up by adding a 2 per cent. aqueous solution of pyronin to the alcoholic alphanaphthol solution given above in the proportion of one drop of the pyronin to 2 cm. of the alphanaphthol solution. Prevent evaporation by staining in a closed container.

Wash in water; then, for fifteen to twenty minutes in a saturated aqueous solution of lithium carbonate. Wash thoroughly in several changes of

¹ Journal of Medical Research, 1916, xxxv, 231.

water. Dehydrate in 80 per cent., followed by 95 per cent. alcohol, transfer to a slide and clear with xylol by the blotting method. Mount in a neutral balsam.

The preparations show an intense red coloration of the granules. Nuclei are greenish blue to blue. The methods possess distinct advantages over previous methods in that the reagents are more easily obtainable and more permanent; satisfactory counter-staining is possible in tissues and blood smears; sections can be cleared and mounted in balsam; finally, the preparations are permanent.

Lemchen¹ makes a preliminary report on the study of the blood with a NEW STAIN. Smears are treated for half a minute with a saturated solution of benzidine in absolute alcohol, then hydrogen peroxide is added, and after another half-minute the slide is washed in water and dried on filter paper. Red cells, including nucleated red cells with the nuclei, are stained blue. If blood smears are allowed to stand for several hours so that fibrin will form, the fibrin also stains blue. On the other hand, white cells and platelets do not take the stain. Taking it for granted that cells and tissues of similar composition will react alike to stains, the author concludes that the red cells and the white cells have a different origin, that platelets do not originate from the red cells. He suggests that the breaking down of red cells forms a substance necessary for the coagulation of the blood. Fibrin has apparently the same composition as the red cells. With this same reasoning, he speculates that agglutinins in typhoid might have their origin in the red cells—spleen and hemolymph glands destroy red cells, liberating agglutinins or the substance necessary for their production, with a resulting anemia on the one hand, and, on the other, increase in the size of the spleen and great activity of the lymph and hemolymph glands.

It has long been known that the intravenous injection of the products of protein digestion or of certain bacteria causes a prompt and marked LEUKOPENIA in the peripheral circulation, followed quickly by a leukocytosis. It has been suggested that the leukopenia is the result of the accumulation of the polymorphonuclears in the internal circulation, especially in the liver, spleen and lungs, and Bull² ascribes the removal of living typhoid organisms in the circulation to phagocytosis by polymorphonuclear cells so accumulated in the central organs.

Pepper and Miller³ question this explanation for the leukopenia, and think that at least some of the leukocytes are destroyed. In several experiments they were unable to find the usual accumulation of leukocytes in smears or sections of the internal organs at the low point of the leukopenia. Likewise, the Arneth count during the period of leukocytosis showed so great an increase of young forms as to suggest that at least some of the matured forms had not returned to the peripheral circulation.

Attempts to shed further light on the question by estimating total

¹ Medical Record, 1916, lxxxix, 607.

² Journal of Experimental Medicine, 1915, xxii, 475.

³ Journal of Infectious Diseases, 1916, xix, 696.

nitrogen and allantoin excretion (the latter as being indicative of nuclear metabolism) in rabbits, injected with living and dead typhoid organisms, gave inconclusive results.

Gay and Claypole¹ have described a QUANTITATIVE RESPONSE IN THE LEUKOCYTES OF IMMUNIZED ANIMALS which they claimed to be specific. On injecting a normal rabbit with typhoid bacilli intravenously, there resulted first leukopenia then a hyperleukocytosis; if rabbits immunized against typhoid bacilli were similarly injected, there was found likewise leukopenia followed by a hyperleukocytosis, but the latter was of much greater degree than in the normal animal.

In a rabbit immunized against typhoid bacilli, the injection of *Staphylococcus aureus* produced only a slight grade of leukocytosis. They, therefore, concluded that the extreme hyperleukocytosis of the immunized rabbits is specific.

McWilliams,² in a series of experiments, was unable to confirm these results. Both normal and typhoid-immune rabbits responded with leukocytosis to the intravenous injection of typhoid bacilli, but the response was not different in degree. Typhoid-immune rabbits showed the same grade of leukocytosis when injected with colon bacilli as when injected with typhoid bacilli, and the same was true of rabbits immunized against colon bacilli. The results were the same with killed and living vaccine, and old and new strains of organisms on different media.

In the course of a study of the leukopenia and subsequent hyperleukocytosis following the intravenous injection of typhoid bacilli into rabbits, Miller and Pepper³ observed in one animal, at the height of the leukocytosis, a phagocytosis of erythrocytes in smears from the peripheral blood. Of the large mononuclear cells, representing 4 per cent. of 43,600 white blood cells, the majority showed evidence of active phagocytosis of erythrocytes. These macrophages could not be differentiated from the non-phagocytic mononuclears of the rabbit's blood. In view of the phagocytosis of red cells occurring in typhoid fever, it is interesting that the above instance of phagocytosis followed the injection of typhoid bacilli.

It has previously been shown that benzol when taken into the body is in part oxidized into phenols, some of which are excreted in the urine. It has also been observed that the injection of benzol is followed by a primary fall and rise of leukocytes, a protophase, and this in turn by a secondary fall and rise of the white cells, constituting a DEUTEROPHASE. It has been suggested that the deuterophase is attributable to a slowness of absorption. Brewer and Weiskotten⁴ were, however, unable to show an increase in the phenol-content of the urine, accompanying the deuterophase as is the case in the protophase in rabbits injected with equal parts of olive oil and benzol. Delayed absorption is therefore not an assignable cause.

¹ Archives of Internal Medicine, 1914, xiv, 662.

² Journal of Immunology, 1916, i, 159.

³ Ibid., 383.

⁴ Journal of Medical Research, 1916, xxxv, 71.

Weiskotten, Schwartz and Steensland¹ investigated the possibility of an antigen-antibody reaction being the cause of the deuterophase, the antigen perhaps being one formed by the action of the injected material upon some constituent of the animal body. Successive sets of injections were given to each of a number of rabbits, spaced in such a way as to allow time for both of the falls and both of the rises to occur between successive sets. The deuterophase, however, following subsequent injections, was the same in every respect as that following the first injection. There occurred no changes in temperature. The results led the authors to the view that the deuterophase is not the result of antigen-antibody reaction.

Austin and Leopold² report an extraordinary POLYMPHONUCLEAR LEUKOPENIA IN A CASE OF TYPHOID FEVER. The patient, whose disease ran an uncomplicated and otherwise uneventful course to recovery, on the seventeenth day showed a leukocyte count of 7600. Of these cells, 38 (0.5 per cent.) were polymorphonuclears, 7448 (98 per cent.) were lymphocytes. The remaining cells were distributed among large mononuclears 1 per cent., transitionals 0.25 per cent., and basophiles 0.25 per cent. Three days later, of 5400 leukocytes, 81 (1.5 per cent.) were polymorphonuclears and 5103 (94.5 per cent.) lymphocytes. Five days after this there were 4872 (58 per cent.) polymorphonuclears and 3276 (39 per cent.) lymphocytes of a total count of 8400. These are the lowest figures thus far reported in this disease. Of leukopenias occurring in other diseases, there are 3 cases in the literature of a grade comparable to this case: Vacquez and Ribierre's³ case of extensive tuberculosis of mediastinal and peribronchial lymph nodes in which, shortly before death, 8 per cent. of 2300 leukocytes were polymorphonuclears; and 2 cases of staphylococcal septicemia reported by Brown⁴ and Türck.⁵

Phagocytic endothelial cells have long been recognized as playing an important part in the pathology of typhoid fever. They occur not only in Peyer's patches and the spleen, but also in the mesenteric nodes, the liver, bone marrow, clotted blood in the heart and in the alveolar exudate of pneumonia complicating typhoid fever. These cells are strongly phagocytic for other cells, particularly leukocytes and erythrocytes. The effusion in typhoid pleurisy, an uncommon complication of the disease, has been shown to contain endothelial cells, but phagocytosis on the part of these cells has not heretofore been observed. Pepper,⁶ however, reports a case in which a diagnosis of typhoid fever was ventured because of the finding of phagocytic endothelial cells in the pleural effusion. This diagnosis was confirmed by the finding of a positive agglutination test with typhoid bacilli by both the blood serum and the effusion, as well as a positive culture of *Bacillus typhosus* from the blood and the effusion. Red cells chiefly

¹ Journal of Medical Research, 1916, xxxv, 63.

² Journal of American Medical Association, 1916, lxvi, 1084.

³ Bull. et mém. Soc. méd. d. hôp. de Paris, 1900, series 3, xvii, 914.

⁴ American Medicine, 1902, iii, 649.

⁵ Wien. klin. Wchnschr., 1907, xx, 157.

⁶ American Journal of Medical Science, 1916, cli, 663.

had been ingested by the phagocytes, but in several instances lymphocytes and one polymorphonuclear had been engulfed. In addition to the correlation of typhoid pleurisy to the general pathology of typhoid fever, the author believes this observation to have a diagnostic significance, in that a diagnosis of typhoid pleurisy would be warranted with some confidence on finding a similar cytology.

Coagulation. Platelets. By studying the process of clotting with the ultramicroscope, Howell¹ has confirmed and extended Stübel's² discovery that in clotting the FIBRIN is deposited as separate NEEDLES OR CRYSTALS, and not as a fine reticulum of fibrin threads holding water within its meshes, as the structure of the fibrin-gel has usually been viewed.

The mode of formation of the fibrin needles was observed by using cell-free oxalated plasma and a thrombin solution. Such a plasma under the ultramicroscope showed a luminous cone, marking the beam of light, in which no visible particles could be distinguished, the colloid material existing in a degree of dispersion not resolvable by the ultramicroscope.

Appearances observed on mixing the two solutions varied according to conditions. If the amount of thrombin was insufficient to cause prompt or complete clotting, there appeared first an increased luminosity of the opalescent cone, and later, separate minute fibrin needles, floating slowly about, and never numerous enough to cohere into a solid mass. Such a mixture grossly showed no visible clot. If the amount of thrombin was sufficient to give a perceptible clot, the needle formation was rapid until there resulted a meshwork of intermingled crystals. Under appropriate conditions, the steps in the formation of the needles were, first, an intensification of the luminosity of the opalescent cone. Then, a granulation of the whole field. Brilliant shimmering particles appeared, exhibiting not only the usual Brownian movements, but, in many cases, also abrupt jumping movements which took them into or out of focus. These particles rapidly took the shape of small rods, like bacilli, and then grew into longer crystals or needles, 10 to 30 microns in length. At the same time, the Brownian movements grew less, and finally there was a mass of brilliant stationary needles closely intermeshed. The author infers that, due to the interaction of fibrinogen and thrombin, the fibrin needles are formed by the aggregation of the amicros of the fibrinogen solution, and that under the influence of the thrombin a vectorial force is brought into play, controlling the agglutination of the particles into definite crystal-like needles. This is in contradistinction to the precipitation of fibrinogen from its solutions by other agents such as heat, acids, etc., in which cases the fibrinogen particles are gathered in amorphous clumps.

A structureless gel, characterized by lack of structure under the ultramicroscope, transparent appearance, and diminished or lacking contractility, was formed from fibrinogen by thrombin action under certain conditions. Excessive alkalinity of the media, too old solutions of fibrinogen, plasma that had been dried and redissolved, in cat's plasma

¹ American Journal of Physiology, 1916, xl, 526.

² Plüger's Archives, 1914, clvi, 361.

in excessive dilution, were found to give a structureless gel. Levy and Rowntree¹ observed in animals, after the intravenous injection of emetine chloride, a delayed coagulation of the blood, and a non-retractile clot. Sosman obtained similar results by the intravenous injection of oxidized epinephrin. The author's investigation showed in both conditions a structureless clot.

Retractility of the clot seems to be directly connected with the existence of fibrin needles. The structureless clot is soft, transparent, non-retractile, and shows no formation of an expressed serum. The crystalline gel always shows a marked tendency to contract. Crystalline-gel formation was observed in all the vertebrates studied. It was most perfect in the mammalia. The blood of invertebrates gave a structureless gel. The author suggests that the development in the vertebrates of a fibrinogen capable of crystalline retractile gellation is an expression of the more perfect adaptability of this form of clotting to prevent hemorrhage.

For the author's discussion of the theories of gel formation, the reader is referred to the original article. Howell believes that in the formation of a crystalline fibrin gel the thrombin does not act as an enzyme, but that the needles are formed by a physical union of thrombin and fibrinogen particles. Such a fibrin gel will separate out completely from highly dilute solutions. This is in contrast to crystalline gel formation in the case of soaps or fats or barium malonate, in which the crystals separate out from a saturated solution and in whose liquid phase the solute is present in strong concentration.

Minot, Denny, and Davis² conducted a series of studies on the PROTHROMBIN AND ANTITHROMBIN FACTORS IN BLOOD COAGULATION in normal individuals and in a number of diseased patients.

Antithrombin amounts were compared by the antithrombin factor, a figure obtained by dividing the coagulation time of a given fibrinogen solution, in the presence of a given amount of the antithrombin to be tested, by the coagulation time of a similar mixture in which antithrombin of normal persons is employed. If 1 represents the average normal factor, it was found that in normal individuals a variation existed between 0.68 and 1.47. If the factor is above 1.81 or below 0.55, the authors conclude that such a factor is surely abnormal. A positive increase of antithrombin was observed clinically in 3 cases, one of hemophilia, one of acute splenomyelogenous leukemia and one of aleukemic leukemia (?) with purpura. A relative excess was present in certain cases in which the prothrombin was diminished, such as jaundice and some cases of hemophilia. Diminution in antithrombin was found in cases of severe typhoid fever, some cases of leukemia and some cases of pernicious anemia.

An actual increase of prothrombin was observed in one case of aleukemic leukemia, also in the blood of dogs as compared to that of man.

In studying the prothrombin time, that is, the coagulation time on

¹ Archives of Internal Medicine, 1916, xvii, 420.

² Ibid., 101.

recalcification of oxalated plasma, the authors found, in 91 determinations in 61 normal persons, variations of six to fourteen minutes. They found that when a series of normal plasmas were tested at the same time, there was a distinct tendency for the prothrombin times to be grouped in a high, medium or low range, *i. e.*, there would be variations from 10 to 14, 6 to 8 or 10; only once did 6 (this case had no food for eighteen hours) and 14 occur at the same time.

Since temperature variation seemed to be a possible cause of this variation in prothrombin time, the matter was further investigated by Minot¹ who found that wide variations could be attributed to this factor. The shortest time was observed at temperature nearest the body temperature. As lower temperatures were used the clotting time increased with a progressively greater rapidity. This was particularly true below 22° C. Abnormal sera with increased prothrombin time showed a parallel curve. Minot therefore suggests that in studying prothrombin time there be used a constant temperature, preferably 22° C., for at this temperature abnormal sera vary sufficiently from normal sera so as to be readily detected. By the same token a normal control serum should always be used.

It has been shown that prothrombin is present in considerable quantities in the blood platelets. This fact in turn strengthens the conviction that the platelets do not arise from the erythrocytes or the leukocytes, both of which have been shown to possess no prothrombin, but, following the work of Wright,² from the megacaryocytes of the bone marrow. Drinker and Drinker³ studied the prothrombin-content of the perfusate obtained on perfusing bone marrow. They found that prothrombin is formed in large amounts in the bone marrow. This prothrombin does not arise either from leukocytes, lymphocytes, myelocytes, nucleated red cells, or wandering endothelial cells, but probably from the megacaryocytes. Perfusates of the liver contain a certain small amount of prothrombin, while those of the spleen contain none.

The perfusion method used was one devised by the authors, and previously reported by them.⁴ Incidentally, they were able to show the presence of vasomotor nerves, that responded to epinephrin and electrical stimulation.

McLean,⁵ in studying the THROMBOPLASTIC ACTIVITY OF CERTAIN PHOSPHATIDS, has confirmed the work of Howell, namely, that cephalin purely prepared possesses marked powers in increasing the thrombic action of fresh serum. He has found also that heparphosphatid, a substance first isolated from the liver by Baskoff, shows a marked power to inhibit coagulation.

Stern⁶ has made certain STUDIES ON BLOOD COAGULATION which are of particular interest WITH RESPECT TO TREATMENT OF ANEURYSMS. Experiments were made *in vitro* with copper, iron, and aluminum wire, with and without the passage of electrical current. In the absence of

¹ Journal of Medical Research, 1916, xxxiii, 503.

² Journal of Morphology, 1910, xxi, 263.

³ American Journal of Physiology, 1916, xli, 5.

⁴ Ibid., xl, 514.

⁵ Ibid., xli, 250.

⁶ Ibid., xl, 186.

current, the coagulation time when aluminum is used is 48 per cent. less than when copper is used, and 36 per cent. less than when iron is used. If the wire is used as the positive pole and 2 milliampères of current are passing, the coagulation time is reduced 80 per cent. in the case of copper, 90 per cent. if aluminum be used, while in the case of iron the passage of 1 milliampère of current causes an increase of in coagulation time of more than 125 per cent. Furthermore, the clot obtained with copper in the presence of current tended to be small, charred and brittle, while in all cases with aluminum the clot was greater in amount, never charred, and more normal in color.

Lyon¹ described a SIMPLE METHOD FOR ESTIMATING THE COAGULATION TIME OF THE BLOOD. An ordinary collapsible aluminum cup with a cover is provided with two pairs of notches opposite each other. These support two pieces of platinum wire, each with four small loops. Water at 37° C., is placed in the cup, each loop of the wires touched quickly to a freely bleeding puncture, the wires are placed in the above-mentioned notches and the cover is gently laid over. At minute or half-minute intervals one loopful of blood is immersed in the water, and the wire and the cover quickly replaced. By noting the lapse of time from the start until a drop fails to wash out is found the coagulation time. Results are approximately the same as those given by the Boggs-Russell-Brodie apparatus.

Hemorrhagic Diseases. Lee and Robertson² produced an ANTI-PLATELET SERUM by repeatedly injecting a rabbit with guinea-pig platelets. They studied the effect of THIS ANTISERUM ON PLATELETS AND ITS POWERS IN THE EXPERIMENTAL PRODUCTION OF PURPURA HEMORRHAGICA. They found that the antiserum had a strong specific agglutinating and lytic action on guinea-pig platelets, and that this reaction occurred only in the presence of complement. Injection of antiplatelet serum into guinea-pigs subcutaneously, intraperitoneally or intracardially, produced a condition typical of the acute form of purpura hemorrhagica. There were numerous and profuse hemorrhages, beginning at times within a few hours after injection. The bleeding time was greatly delayed and the platelet count markedly reduced, falling as low as 16,000. The coagulation time was normal, but clots were not retractile. Histological examination of the hemorrhagic areas gave no information as to the manner in which purpura had been produced and had no effect on platelets either *in vivo* or *in vitro*, a fact observed by Minot in a case of idiopathic purpura mentioned elsewhere.

Musser and Krumbhaar³ found a well-marked decrease in the resistance to hypotonic salt solutions of the erythrocytes of the blood of rabbits and guinea-pigs in which purpura had been experimentally produced after the method of Lee and Robertson⁴ by the injection of an antiplatelet immune serum. The antiplatelet serum tested *in vitro* was found to possess hemolytic properties, thus raising the unanswered

¹ Journal of American Medical Association, 1916, lxvi, 891.

² Journal of Medical Research, 1916, xxxiii, 323.

³ Journal of American Medical Association, 1916, lxvii, 1894.

⁴ Journal of Medical Research, 1916, xxxiii, 323.

question whether, in experimental purpura, the destruction of the platelets and decreased resistance of the red cells are due to a single factor in serum, or to two bodies, a hemolytic element in addition to an antiplatelet element.

Minot¹ reports studies on a case of idiopathic purpura hemorrhagica. The investigations were most complete and the results obtained practically summarize our present knowledge of the pathological findings in this condition.

The patient, a Jewess, aged eighteen years, showed, during a period of thirteen months an increasing purpuric eruption, during the last six months of which there were hemorrhages from the gums, vagina, uterus, and kidneys. Temporary remissions were observed after transfusions, of which the patient had eleven, but her condition grew progressively worse, and finally ended with death after her discharge from the hospital.

Physical examination, save for the local hemorrhages on the skin, mucous membranes, retina, etc., was negative. Wassermann, negative.

Red Cells. Counts fluctuated between 3,664,000 and 920,000, higher counts being observed immediately after transfusions. The hemoglobin varied from 65 per cent. to 20 per cent., the color-index being usually below 1, though sometimes 1. After transfusion the hemoglobin rose relatively more than the red count. The red cells always showed considerable achromia, some poikilocytosis when the red count was lowest, a tendency to diminution in size. Polychromatophilia was very slight. On a few occasions normoblasts were found, but very rarely, and at no time were megaloblasts seen.

Reticulated cells (vital stain with brilliant cresyl blue) were always present in abnormally high numbers, higher when the red count was lower, a time when one would expect a greater effort on the part of the marrow to regenerate cells. The lowest percentage of the reticulated cells observed was 5.25 and the highest 19 per cent., the normal being not over 1 per cent. This would argue for an active marrow, and the patient's condition could not be interpreted as an aplastic anemia with a symptomatic purpura, a condition that should be considered separately from an idiopathic purpura.

The fragility of the washed red cells was practically normal. There was no increase in urobilin output in the feces; the anemia was therefore due entirely to hemorrhage and not to increased hemolysis.

The white cells showed no striking abnormality. Counts varied between 6400 and 22,000; polynuclear cells ranged from 54 to 72 per cent., again indicating an active marrow. The Arneth picture remained normal or showed a slight shift to the left, not to the right as found in pernicious anemia.

The Platelets. The count was always abnormally low, lowest at the times of the greatest bleeding. Counts as low as 1000 were observed at such periods. Highest counts were obtained after transfusions, 118,000 and 120,000 being found on two occasions. Duke² has shown

¹ American Journal of Medical Sciences, 1916, clii, 48.

² Journal of Experimental Medicine, 1911, xiv, 265.

that the *life of the platelets* is probably but a few days, and that the improvement after transfusion of cases with very few plates lasts for but a few days or until the platelets introduced have disappeared, unless the transfusion is successful in permitting the patient to supply or not destroy his own platelets. In this case, the low platelet count seems to have been due to one or both of the following two factors:

1. Some reaction (presumably a specific poison) taking place in the body, which destroyed the platelets as fast as they were formed.

2. A localized aplasia of the platelet-forming elements of the marrow, due possibly to some toxic phenomena.

This destructive process seems to have been specific because none of the other formed blood elements were involved.

Serum. *In vitro* the patient's serum caused no abnormal lysis or agglutination of normal platelets. Injection of patient's serum and blood into animals caused no purpuric manifestations, nor was patient's serum more toxic for rabbits than normal serum.

Bleeding Time. Duke¹ observed that with a much-reduced platelet count, bleeding from a small puncture occurred for an abnormally long time. This time fluctuated with the number of platelets. A normal bleeding time of under three minutes occurred only when the count was above 60,000 in the present case. The bleeding time was longer with a larger than with a smaller puncture and shorter from the arm vein than the ear, which was not due to a difference in the platelet count.

Coagulation of the Blood. Normal, decreased, and increased coagulation time of the whole blood have been reported in cases of purpura. Prothrombin and antithrombin have been reported as normal or varying slightly above or below normal. In this patient there was usually a delayed coagulation time, a weak, non-retractile clot associated with a delayed prothrombin time which did not vary directly with the platelet count or clinical symptoms. The antithrombin was normal. Washed and unwashed platelets from the patient were found to have fully as much thromboplastic activity as normal platelets. This agrees with Fonio's² hypothesis that though the platelets are lacking in number, they are not lacking in activity. Salt-and-water extracts of the uterus accelerated the clotting of normal oxalated plasma. There was thus no evidence of deficient thromboplastic activity. (Hysterectomy had been done on the patient to check hemorrhage from the genital tract, but without any definite influence on the course of the disease.)

Howell³ has studied the clotting of blood under the ultramicroscope and has found different appearances of the fibrin needles under different conditions. He was unable to detect any abnormality in this case.

Tourniquet Sign. The effect of placing a tourniquet about the arm for three minutes so that the return blood flow is shut off was studied in this case, petechiæ being looked for below the point of application and after removal of the tourniquet. The test, when positive, is considered indicative of diminished resistance in the walls of the smaller

¹ Loc. cit.

² Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1914, xxviii, 313.

³ American Journal of Physiology, 1914, xxxv, 143.

vessels. In this patient the sign was positive, being greatest at times when there were spontaneous purpuric lesions on the skin.

No fibrinolytic ferment was found.

Hydrogen-ion concentration of the blood was normal.

Treatment. The essential treatment consisted of trying to replace the lacking platelets by transfusion, resulting in temporary improvement of the patient's condition, in turn associated with a temporary rise of the platelet count. Thromboplastic substances, "kephalin"—the active thromboplastic substance from sheep's brains, and "coagulen," a substance derived from platelets, used locally and subcutaneously, were perhaps of benefit in temporarily controlling hemorrhage. Kephalin locally acted better than any astringents.

Benham¹ reports a case of *Purpura Hemorrhagica following Menorrhea*. The patient, a woman of thirty-four, showed a purpuric eruption on the shins, later also in other parts of the body, the eruption tending to come in crops especially during the menses. The menses were very profuse and prolonged. At the end of two years blood examination showed 1,600,000 red cells, 30 per cent. of hemoglobin, 5400 white cells, greatly reduced number of platelets and a retarded coagulation time. At first no local cause of the menorrhea was discoverable. Later, a cervical erosion was found. During this time horse serum, coagulose, human serum and transfusion, locally, styptics were used without continued benefit. Finally, the cervix was amputated with subsequent uneventful recovery. Menses now last 5 days. Patient's general condition much improved. She still has some purpura. Benham suggests that the cervical laceration produced a subinvolution of the uterus, predisposing to increased and prolonged menstrual flow which, in turn, reduced the quantity and altered the quality of the blood. Platelets were lost faster than they could be formed, resulting in the increased coagulation time. The occurrence of the purpura at the menstrual period would indicate that at that time coagulation power is lowest.

Emsheimer² reports a case of *purpura hemorrhagica treated by intramuscular injection of whole blood*. The patient, a boy aged five and a half years, had been ill for 17 days with severe purpuric eruption and marked hematuria. During the last 7 days his condition had been growing progressively worse in spite of treatment, including calcium, epinephrin, arsenic and coagulin by mouth. Sixteen hours after the injection of 20 c.c. of whole fresh blood, hematuria ceased, the child began to be generally improved, with subsequent cessation of all symptoms and being in apparently normal health 3 months later. Because of its simplicity, the author recommends this treatment as preferable under the circumstances to transfusion or injection of human serum subcutaneously or intravenously.

Schlenker³ reports a case of *purpura hemorrhagica* in which cure was effected by the injection of 100 c.c. of horse serum in daily 10 c.c. doses. No other treatment was used.

¹ Surg., Gyn. and Obst., 1916, xxiii, 65.

² Journal of American Medical Association, 1916, lxvi, 20.

³ Ibid., 1021.

Cole and Querens¹ report a case of purpura hemorrhagica treated with *emetine hydrochloride*. The patient, a man, aged fifty-two years, had a generalized purpuric eruption, marked bleeding from the gingival margins, some fever, symptoms being of four days' duration. Astringents locally were of no avail. On the fifth day one-half grain of emetine hydrochloride given intramuscularly was followed almost immediately by the appearance of a hematoma. Two subsequent doses were given in this way with the same results and without improvement of the patient's condition. Thereafter two doses of one-half grain each given daily, intravenously, were followed after twenty-four hours by definite improvement. After ten doses had been given, all symptoms had disappeared.

Norris² also reports a case of purpura hemorrhagica in which a cure was effected by the use of emetine.

Hemophilia. Minot and Lee³ studied the PLATELETS in two cases of hemophilia. Previous work has shown that, in typical hemophilia, the formed elements are normal in numbers. The calcium and fibrinogen-content of the blood and thrombin in the serum are within normal limits. The activity of the tissue juice in initiating clotting is probably normal. The prothrombin time is markedly delayed.

The authors found that if normal blood platelets in normal amounts were added to hemophilic plasma, they caused it to coagulate in a time that was normal or nearly so. When hemophilic platelets were added, even in seventy-five times the concentration of normal blood, coagulation time, though definitely shortened, was never brought near to the normal. By using the method of formation of thrombin described by Bordet and Delange,⁴ it was found that platelets from hemophilic blood required more time to form thrombin than did normal platelets. Oxalated plasma recalcified by less than the optimum amount of calcium showed wide discrepancies in the clotting time when normal and hemophilic platelets were added. Partial solution of hemophilic platelets in water were more efficient than hemophilic platelets in suspension.

From these facts, the authors conclude that in hemophilia there is an hereditary defect in the blood platelets, a slow availability of the platelets for the initial step of coagulation, which seems to be a rendering available of the platelets by some process of solution. In Howell's terminology, this would be an inability of the platelets to give up their prothrombin as readily as normal platelets, rather than a deficiency in prothrombin content.

There is further suggested the theory that the active coagulating principle of the tissue juice is derived in part, if not wholly, from the blood platelets. It is proposed that once the resistant hemophilia platelets go into solution there results an essentially normal tissue juice. Since tissue juice is probably the important element affecting the bleeding time, rather than the platelets, it is conceivable why the blood

¹ New Orleans Medical and Surgical Journal, 1916, lxviii, 473.

² China Medical Journal, xxxi, 334. (Magazine not available.)

³ Archives of Internal Medicine, 1916, xviii, 474.

⁴ Ann. de l'Inst. Pasteur, 1912, xxvi, 657 and 737.

clots rapidly, *i. e.*, the bleeding time is normal when a small puncture is made in the ear with an attending oozing of sufficient tissue juice. If the wound is large, so that the loss of blood is rapid, it is conceivable that enough tissue juice is not available to check such a hemorrhage. In purpura, on the other hand, the number of platelets is greatly reduced, making it impossible to keep the tissue juice supplied with platelets in solution. Such a deficiency of the tissue juice could explain the abnormally long bleeding time seen in purpura.

In one hemophilic patient, after transfusion, a clotting time of sixty to one hundred and twenty minutes was found reduced to seven minutes. A gradual lengthening of this time occurred during the following three days, at the end of which time it was again sixty minutes. Granting that the effect was due to the normal platelets added, the coagulation time lengthening as these normal platelets disappeared or "died out," it would seem that three days was the span of life of normal platelets. This clinical observation confirms Duke's¹ results *in vitro*.

Hurwitz and Lucas² report STUDIES OF THE BLOOD IN THREE CASES OF HEMOPHILIA. In general, their findings corroborate previous observations made in this condition. No alteration was observed in the blood reaction, the hydrogen-ion concentration being within normal limits. Clot formation, though slow, when once formed gives a normal retractile clot. Percentages of serum albumin, serum globulin and total serum protein show no wide variations from the normal. Antithrombin and fibrinogen are present in normal amounts. There is a diminution of the circulating prothrombin. An interesting observation, in two of the cases that were studied over a period of six months, was that wide fluctuations in the prothrombin content occurs, both during the hemorrhagic and interhemorrhagic periods. There was, however, no definite relationship between the extent of the prothrombin deficiency and the gravity of the clinical symptoms. Kephalin applied locally had excellent hemostatic properties; oral, subcutaneous and intramuscular administration, however, had no effect on the disease. Suberythema doses of Röntgen rays did not influence the disease process, nor was there effected any alteration in coagulability or the prothrombin-antithrombin balance of the blood.

Addis³ found that the intravenous injection of FRESH HUMAN BLOOD SERUM causes an immediate shortening of the coagulation time of the blood in cases of hereditary hemophilia. This is followed by a gradual lengthening of the coagulation time until it is considerably longer than before injection; finally, there is a return to the original level. Similar results are obtained when phosphated whole fresh blood is injected intravenously. An alteration of the prothrombin content of the plasma was found to be the cause of the changes noted.

Kahn⁴ found, in studying 2 cases of hemophilia, that PROTEIN METABOLISM, as measured by the nitrogen and sulphur output, is

¹ Journal of Experimental Medicine, 1911, xiv, 265.

² Archives of Internal Medicine, 1916, xvii, 543.

³ Proceedings of the Society for Experimental Biology and Medicine, 1916, xiv, 19.

⁴ American Journal of Diseases of Children, 1916, xi, 103.

normal. In the one case, a true hemophilic with typical history of heredity, the calcium content of the blood was normal. In the other, a patient without such a family history, and clinically showing a tendency to bleeding from small cuts, etc., a case as it were of "sporadic hemophilia," there was a distinctly lowered calcium content of the blood, with a negative calcium balance before, and a positive balance after, calcium feeding. In both patients the excretion of calcium in the urine, as compared with the excretion of calcium in the feces, was about the same as compared with the normal.

Bauch¹ reports 3 cases of purpuric disease occurring in patients suffering from pulmonary tuberculosis. Clinically, the cases suggested true idiopathic purpura hemorrhagica. The platelet counts in all 3 cases, however, were normal. The author suggests a possible etiological relationship, local action of tubercle bacilli or tuberculous toxins being the causative factors.

Hemolytic Icterus. Brewer² reports 2 cases of SPLENOMEGALIC HEMOLYTIC ICTERUS greatly IMPROVED, if not cured, BY SPLENECTOMY, and briefly discusses the disease.

The essential features of splenomegalic hemolytic icterus are chronic jaundice and enlargement of the spleen. The jaundice is of a bright, lemon-yellow color which varies in intensity but is seldom, if ever, wholly absent. It is never associated with pruritus, torpor or slow pulse. Stools are always brown and, with the urine, contain increased quantities of urobilin and urobilinogen. In most cases, but not in all, there is increased fragility of the red cells when treated with hypotonic salt solutions. Enlargement of the spleen is present in all cases; in the earlier stages, this may readily be overlooked, but in the later stages may reach enormous size.

An interesting feature of the disease is its tendency to appear in several members of the same family, and this has led to the general employment of the term familial hemolytic jaundice. The disease may be congenital or acquired, is, as a rule, exceedingly chronic and has a much more favorable prognosis than other forms of splenic anemia. It may exist throughout a long life without causing marked impairment of health in some cases. In perhaps the majority of instances, symptoms sooner or later appear which may result in invalidism or death. In the congenital cases, the jaundice appears at, or soon after, birth. As a rule, there are no other symptoms, and the child may reach adolescence without impairment to health. In other cases the child is never robust, the jaundice becomes more pronounced, the appetite is capricious, there are minor digestive disturbances and anemia of the chlorotic type appears, the degree of anemia often being in direct proportion to the degree of the jaundice. In the acquired cases, the jaundice is first observed during adolescence or early adult life. In the majority of the acquired cases, and in many of the congenital type, there occurs, sooner or later, a series of febrile attacks or crises in which there may be chills, elevation of temperature, pain

¹ Archives of Internal Medicine, 1916, xvii, 444.

² Medical Record, 1916, xc, 1.

in the upper abdomen, particularly on the left side, and tenderness of the spleen on palpation, general malaise, increase of jaundice; nausea and vomiting may occur, occasionally diarrhea and severe prostration. During these attacks there is increased excretion of urobilin and the urine may become blood red (hemoglobinuria). After each attack the patient appears more anemic, the anemia which is at first always of the chlorotic type gradually changes to the pernicious variety, splenic enlargement becomes more and more pronounced, and in these cases, if untreated, the prognosis is fatal.

The spleens grossly show marked hypertrophy, hyperemia, a diminution in the number and size of the Malpighian follicles, and in some instances thickening of the capsule and adhesions to the diaphragm and abdominal wall. Microscopically, the intense blood engorgement is found to be chiefly in the interstices of the splenic pulp, the sinuses being nearly empty. The endothelial cells of the sinuses are greatly reduced in size; the pulp arteries are occasionally surrounded by fibrous rings in a state of hyaline degeneration; phagocytosis is marked, particularly in the sinuses. Certain of the changes give evidence of the presence of a chronic inflammatory process, and it is interesting to note that various organisms have been isolated from these spleens; finally, Kumpless, in an analysis of 79 cases, was able to establish the association with syphilis in 12, and of tuberculosis in 5 cases.

As to the *etiology*, Brewer believes, with Eppinger, that the condition may be considered a "hypersplenism," an exaggeration of the normal hemolytic processes of the spleen and possibly other tissues of the body, that this excessive hemolytic activity is in all probability chiefly due to pathological changes in the spleen, and that there is some reason to believe that these changes may be the result of one or more types of chronic infection.

In regard to *treatment*, Banti was the first to employ splenectomy in 1903. Since that time the operation has been repeatedly done, and Brewer cites Elliott and Kannavel's report of the literature, mentioned in this section last year, there being 48 operations with 2 deaths.

The following 2 cases are reported by the author:

CASE I.—Nurse, aged thirty years. Jaundice for seventeen years. Several members of mother's family have also suffered from unexplained jaundice. At first no symptoms. After 1899, however, experienced attacks of abdominal pain, anorexia, constipation and increased jaundice. No disappearance of the jaundice in intervals. In 1904, a more severe attack with markedly increased icterus. In June, 1906, operated upon for jaundice and epigastric pain. Gall-bladder found normal; no stones. Several months later, following another attack she underwent a second operation. Several small stones found. Gall-bladder drained for twelve days. Jaundice decreased, but did not disappear.

During 1908 and 1909, several more or less severe attacks of pain; one with jaundice, sour vomiting, and diarrhea, but without clay-colored stools, and another with some pain radiating to the right shoulder. For the next five years, pain, nausea, fever, diarrhea and a

varying jaundice. Finally diagnosed by Dr. Lewis A. Connor as familial hemolytic jaundice.

October 8, 1915. Slightly jaundiced; chest negative; splenic enlargement, easily palpated for 1 or 2 inches below the costal border; stools brown, contain urobilin; urine negative. Blood: coagulation time, seven minutes; red blood cells, 3,408,000; hemoglobin, 75 per cent.; white blood cells, 11,800; polynuclears, 78 per cent. Hemolysis test: hemolysis begins at 0.375, complete at 0.35. Wassermann negative.

October 23. Splenectomy.

November 11. Red blood cells, 4,216,000; white blood cells, 11,000; polynuclears, 88 per cent.

November 14. Hemolysis test, 0.55 to 0.4, almost free from jaundice.

May 2, 1916. Hemolysis index, 0.489; hemoglobin, 75 per cent.; red blood cells, 4,800,000; white blood cells, 13,400; polynuclears, 44 per cent.; lymphocytes, 54 per cent.; blood cholesterin, 3.61 gm. per liter.

CASE II.—H. O'S., aged twenty-one years. No family history of jaundice. Three years ago gradual onset of jaundice with lassitude. Gradually grew weaker, suffered from occasional pains in upper abdomen; anorexia and constipation.

November 18, 1915. Scleræ jaundiced; spleen enlarged, easily palpable 1 inch below costal border. Blood: red blood cells, 3,064,000; hemoglobin, 70 per cent.; white blood cells, 9500; polynuclears, 89.5 per cent.; lymphocytes, 10 per cent. Hemolysis test: hemolysis begins at 0.425, complete at 0.4. Wassermann negative. Vital stain: reticulated cells, 27 per cent. Stools brown, urobilin marked; urine negative.

December 4. Splenectomy.

December 18. Fragility test: 0.489 to 0.483; red blood cells, 13,500; polynuclears, 68 per cent.

December 21. Jaundice gone.

May 2, 1916. Fragility test, 0.595; white blood cells, 15,000; polynuclears, 54 per cent.; lymphocytes, 46 per cent.; blood cholesterin, 2.77 gm. per liter. Vital stain: reticulated cells, 5 per cent.

July 1, 1916. Both patients free from jaundice, much improved in health, able to work.

An unusual feature of the 2 cases above mentioned is the comparatively low figures for hemolysis of red blood cells, followed by a pronounced rise, *i. e.*, increased fragility after splenectomy.

Davis¹ has investigated the FRAGILITY OF THE ERYTHROCYTES in a series of cases with anemia, including hemolytic icterus, obstructive jaundice and pernicious anemia with the findings that fragility in hemolytic icterus is normal or appreciably increased. In obstructive jaundice the fragility is quite uniformly decreased, a difference which may be of value in differential diagnosis. In pernicious anemia the fragility is regularly decreased. To explain these facts, he quotes King,² who claims to have found in the group of diseases a marked disturbance in the normal relation of fats, cholesterin bodies and unsatu-

¹ Illinois Medical Journal, xxix, 280.

² Archives of Internal Medicine, 1914, xiv, 145.

rated fatty acids, the first two being antihemolytic and the last strongly hemolytic. Furthermore, King claims that after splenectomy there is an increase in fat content and decrease in the unsaturated fatty acids in the blood.

Friedman and Katz¹ report a case of ACQUIRED HEMOLYTIC JAUNDICE WITH SPLENECTOMY. The patient, a young Italian male, aged eighteen years, in America for one and a half years, with a negative family history, and no history of previous illnesses, first noticed in March, 1915, that his skin and eyes were rapidly becoming yellow. Two days later he felt drowsy and weak, and on the following day had a high fever with several chills. For two weeks the high fever persisted and the patient remained in bed. Thereafter he was able to return to work, without, however, any cessation of the jaundice, and with a daily rise in temperature to 99° or 100° F., preceded always by a slight chill. On November 9, examination showed an enlarged spleen, and a blood count of 4,500,000 red blood cells, 68 per cent. of hemoglobin, 4200 white blood cells with 78.5 per cent. of polymorphonuclears. Repeated search for malarial plasmodia was negative. On November 15, there were 4,200,000 red blood cells, of which 16 per cent. took the vital stain. The resistance of the red blood cells to hypotonic salt solutions was slightly diminished, and the urine contained urobilin and urobilinogen.

On November 23, the spleen weighing 800 gm. was removed. The chief microscopic feature was an interstitial suffusion with red blood cells. There was no fibrous hyperplasia.

Six days after the operation, the blood count showed 5,120,000 red blood cells and 88 per cent. of hemoglobin, 11,000 white blood cells with 73.6 per cent. of polymorphonuclears. Six months later the resistance of the red blood cells was normal, and reticulated cells were not seen. On March 20, 1916, there were no subjective symptoms and no signs of icterus. The blood and urine were normal.

Miller² reports on SPLENECTOMY IN SPLENIC ANEMIA, HEMOLYTIC ICTERUS and HANOT'S CIRRHOSIS.

The operative mortality of splenectomy in splenic anemia has been considerably reduced since Banti's report of 44.4 per cent. mortality in a series of 36 cases. The mortality in 118 cases collected from the literature since 1900 is 19 per cent., and in the Mayo series of 18 cases there were only 2 deaths; 12 of the 16 patients of this series that recovered from the operation were in excellent health in 1915, 2 were definitely improved and 2 died, 1 developing ascites, and the other of an unknown cause two years after operation.

The value of splenectomy in hemolytic icterus is well established. Miller quotes Elliot and Kanavel's collection from the literature of 48 cases, with an operative mortality of 4.1 per cent. (2 cases) and cure in the 46 cases that recovered from the operation.

There have been reported only 3 cases of splenectomy in Hanot's cirrhosis, 2 by Eppinger and 1 by Mayo, and all 3 have been reported as cured.

¹ Journal of American Medical Association, 1916, lxxvii, 1295.

² Ibid., 727.

Leukemia.—In discussing the CLINICAL DIAGNOSIS OF ACUTE LEUKEMIC STATES, Barker, Baetjer and Miller¹ point out the difficulty in distinguishing between an acute myeloid leukemic state and an acute lymphadenoid leukemic state in cases in which all the cells are non-granular and about the size of large lymphocytes. Careful study of the exact morphology may suffice to distinguish between lymphocytes and micromyeloblasts, but staining reactions, especially the demonstration of oxydase ferment, is much more reliable. Further, it is erroneous to think that cases in which the lymph glands are markedly enlarged are necessarily instances of lymphadenoid leukemia, just as it is wrong to assume that marked enlargement of the spleen without enlargement of the lymph glands necessarily indicates that the leukemia is myeloid in origin. Histological study of an excised gland is the most certain mode of arriving at a diagnosis.

Stein,² in a discussion of the NATURE OF THE LEUKEMIAS, particularly with reference to the PATHOGENESIS OF ACUTE LYMPHATIC LEUKEMIA, argues for the infectious nature of this latter condition.

In the first place he selects a phenomenon commonly observed in infectious disease which is similarly observed in acute lymphatic leukemia—the phenomenon of leukocytosis, in this instance, of lymphocytosis. According to Virchow, leukemia is a progressive leukocytosis. Now, aside from certain well-defined physiological states like hunger, digestion, pregnancy, lactation, and aside from variations of the leukocyte count due to stimulation or inhibition of the endocrine organs and the phenomenon of anaphylaxis, leukocytosis is exclusively and constantly associated with infection. The leukocytosis varies in kind, number and relative proportion according to the nature of the infection. In a well-marked infectious condition we are led to expect a certain well-defined leukocyte count, which, in conjunction with other signs, will indicate the character, phase, or stage of that case of infection. If this count varies, we at once look for complications to explain the atypical or anomalous blood count. Clinical experience has shown that certain infectious diseases, such as variola, lues, tuberculosis, typhoid fever, malaria, pertussis, are attended by, or produce, not the ordinary polynucleosis, but a lymphocytosis, absolute or relative. In certain infectious diseases the lymphocytosis induced by some special lymphotactic agent reaches excessive figures. How is this explained? Primarily by the character of the infective agent. Lymphocytes contain a fat-splitting lysolytic ferment. Lymphocytosis might be defined as an antagonistic reaction against lipid substances. The bacillus of tuberculosis and the spirochete of lues, two of the diseases above mentioned, have a fatty covering. We may infer that severe infections of a lymphotactic nature may prepare the foundation for a leukemic invasion.

Further, the writer draws attention to the clinical grouping of cases recorded hitherto. There is the enteric type described by Mosler, with severe enteritis and bloody stools, suggesting an infection of the intestinal tract. Then there is the purpuric or scorbutic type, with hemor-

¹ Southern Medical Journal, 1916, ix, 107.

² Medical Record, 1916, xc, 147.

rhages from nose and mouth and into the skin, a type frequently beginning with angina and glandular swelling, or in aggravated forms with ulceration. The author here refers to an unpublished series of cases of Sondern of Vincent's angina—15 cases—with positive bacteriological findings and a very high grade of lymphocytosis.

Finally, we have hitherto considered leukemia an invariably fatal disease. Now there are certain cases which have all the signs of infectious disease, which are clinically hematologically and pathologically analogous to, if not identical with, acute lymphatic leukemia: cases which range through various degrees of severity from a comparatively mild type of infection, to the severer and fatal cases. The author therefore suggests: *Acute Lymphatic Leukemia; A Clinical Form of Infection, of Mild, Severe, and Fatal Type.* Of the first type are cases of infections accompanied by remarkably high lymphocytic blood. Cabot¹ describes some of these cases under the heading "Lymphocytosis of Acute Infection." Stein now cites a case of a male child, aged seven years, with normal blood count when in good health, developing an acute head and chest cold—all members of the household had colds. Temperature, 101° to 103°. Continuous rapid enlargement of the spleen. Liver felt. General moderate swelling of the lymph nodes. Blood count on the seventh day of the disease: 21,900 white blood cells; 19.5 per cent. polynuclears; 65 per cent. small lymphocytes; 12.5 per cent. large lymphocytes; 5 per cent. transitionals; 1 per cent. eosinophiles. A diagnosis of acute lymphatic leukemia was made and a serious prognosis given. However, the symptoms subsided, the lymphocytosis completely disappeared in the fourth week, as also the swelling of spleen, liver, and lymph glands. A blood count in a cold one year later showed 6400 white cells, 21 per cent. small lymphocytes, 16 per cent. large mononuclears. Türk reports a small series of similar cases. Since these cases are apparently infectious, and end in recovery it is inferred that they are not true leukemia, for so far an infectious origin of leukemia has not been demonstrated and cryptogenetic leukemia is always fatal. Again there are cases showing apparently a severe infection in whom there appears suddenly a leukemic blood count. Here again we are prone to look upon the combination of infection and leukemia as accidental and we are loath to accept the theory that the leukemia is the consequence of the infection.

Now, why should the common infections and suppurations produce a lymphatic instead of a myelogenous blood reaction in certain individuals? There must exist some basic condition in the leukemic individual.

Virchow points to the conspicuous enlargement of the thymus in leukemic children: in other words, acute leukemia in children and young subjects is grafted upon the condition known as status thymolymphaticus. This in turn is the individual's constitutional deficiency, a phase of developmental insufficiency.

Sappington² reports *A CASE OF GRAVE ANEMIA THAT PRESENTED,*

¹ American Journal of Medical Science, 1913, cxiv, 335.

² Ibid., 1916, clii, 238.

in the last eight days of life, A BLOOD PICTURE OF ACUTE MYELOBLASTIC LEUKEMIA with extraordinary numbers of nucleated red cells. The patient, when first observed, complained of weakness and prostration; he had been, according to his relatives, distinctly anemic for at least six months, and possibly a year. There was no glandular or splenic enlargement. The Wassermann was negative and various examinations gave no clue as to a possible cause for the anemia. The blood count on November 28 showed 18 per cent. of hemoglobin, 1,130,000 red cells, 7800 white cells, 22 per cent. polynuclears, 66 per cent. lymphocytes, 0.2 per cent. eosinophiles, 11.8 per cent. myeloblasts, 3356 nucleated red cells per c.mm., 62 per cent. being megaloblasts. Taking into consideration the blood count, even though there were 11.7 per cent. of myeloblasts, and the absence of glandular or splenic enlargement and the history of chronic anemia, a diagnosis of pernicious anemia seemed inevitable. However, on December 5 the white cells had increased to 12,000; with 36.3 per cent. myeloblasts, and on December 13 there was a typical picture of an acute leukemia. The count showed 810,000 red cells, 16 per cent. of hemoglobin, 128,000 white cells, 9.2 per cent. polynuclears, 10.8 per cent. lymphocytes, 80 per cent. myeloblasts, 11,265 nucleated red cells per c.mm., 43 per cent. being megaloblasts. On the day of death, December 20, the red cells were 1,030,000; white cells 298,000, 88.6 per cent. being myeloblasts, and nucleated reds 29,334, 60 per cent. being megaloblasts. Autopsy was not obtained.

The case might be considered leukemia throughout with severe terminal anemia. However, the author reasons, the duration of the illness argues against an acute leukemia, while had it been a chronic leukemia, terminating in an acute form, there should have been present glandular or splenic enlargement. The author considers the term "leukanemia" as applicable, implying as it does a combination of leukemic and anemic features, or, as Ewing¹ speaks of it, "a disease which may be regarded provisionally as constituting a point of union of leukemia and pernicious anemia." The presence in this case of large numbers of nucleated red cells and myeloblasts, make its relation to pernicious anemia and leukemia suggestive, in view of the significance of the myeloblast as a primitive parent marrow cell.

Weaver² reports a case of CHRONIC LYMPHATIC LEUKEMIA THAT SHOWED AN ACUTE EXACERBATION JUST BEFORE DEATH. On August 26 the patient was first examined; he complained, at the time, of weakness and general malaise. There was found slight splenic enlargement, enlargement of the superficial glands generally—these according to the patient had been noticed since his tenth year, but lately had become a little larger—and of 8000 leukocytes 98 per cent. were lymphocytes. On the following day the patient walked to a trolley car and went to the hospital where, on August 28, a blood count showed 32,000 leukocytes, only lymphocytes being seen in the smear. Death occurred on August 31 with hemorrhagic manifestations in the alimentary tract and skin. A necropsy was not made.

¹ Clinical Pathology of the Blood, 1903, p. 484.

² United States Naval Medical Bulletin, 1916, x, 668.

Barry and Ketcham¹ report a case of SPLENOMYELOGENOUS LEUKEMIA in which a course of BENZOL in 1 or 2 c.c. doses over a period of three months was the only treatment employed. A white cell count of 350 to 456,000 dropped to 4000; red cells at the beginning were 2,500,000 and six months later were 5,600,000. All symptoms disappeared, and for nearly a year the patient remained in good health, being delivered during that time of a normal child. Eight weeks after delivery she was found at her home in a serious condition of rather sudden onset. A blood count showed 2,800,000 red cells, and 25,000 leukocytes. In spite of treatment—transfusion, and a few doses of benzol given near the end—the patient's condition became progressively worse; death resulted twenty days after her last admission to the hospital. The leukocytes during the period rose to 74,000; myelocytes were present in numbers ranging from 12 to 47 per cent. of the total count.

Grasty² reports a case of acute lymphatic leukemia in which benzol twice effected a marked reduction of the leukocytes, with, however, at the same time a marked reduction of the red cells, and without any influence on the subsequent fatal course of the disease.

Wooley³ reports a case of FETAL ERYTHROBLASTOSIS or congenital general edema. There were the typical findings of this condition, namely, a universal edema, with hydrops of the serous cavities, an edema of the placenta and cord, marked enlargement of liver and spleen, and, microscopically, huge numbers of erythroblasts with many other myeloid cells in liver, spleen and blood. Similar erythroblastic nodules were found in the kidneys and lymph nodes. Wooley's case is unique in that it was one of twins, the other fetus being normal. There is no known cause for the condition. Wooley suggests an analogy between this condition and leukemia, and as the latter has been considered at times as a neoplastic overgrowth, he suggests the term "fetal erythroblastomatosis as being more significant than congenital general edema or fetal erythroblastosis.

Pernicious Anemia. Vogel,⁴ in an excellent article, discusses the theories of the ETIOLOGY of pernicious anemia. Unfortunately, the article is not suitable for abstracting and the reader is referred to the original. Incidentally, he makes the observation that in 7 cases of pernicious anemia in which splenectomy was performed the subsequent effects of transfusion were more marked and persisted longer than in cases in which the operation had not been done.

Christian⁵ has confirmed and extended Mosenthal's⁶ observation of IMPAIRED RENAL FUNCTION in pernicious anemia, as determined by dietary renal tests, comparable to those found in advanced cases of contracted kidney. The method of Hedinger and Schlayer⁷ was used in

¹ Journal of Indiana State Medical Association, 1916, ix, 315.

² American Journal of Obstetrics, 1916, lxxiv, 669.

³ Journal of Laboratory and Clinical Medicine, 1916, i, 347.

⁴ Journal of American Medical Association, 1916, lxvi, 1012.

⁵ Archives of Internal Medicine, 1916, xviii, 429.

⁶ *Ibid.*, 1915, xvi, 733; Proceedings of American Medical Association, Detroit, June, 1916.

⁷ Deutsch. Arch. f. klin. Med., 1914, cxiv, 120.

which the patients are placed on a special diet so arranged that different meals given throughout the day have varying amounts of fluids, sodium chloride, protein and purin bases. There is estimated the amount of urine, its specific gravity, the chloride and nitrogen content, both total and percentage concentration in two-hour specimens collected throughout the day and in a single night specimen. Normally, the factors determined vary according to their relation to the meals and the charted results form an irregular or "picket-fence" curve. In nephritis, these curves are flattened toward straight lines according to the nature and severity of the renal involvement.

Twenty-one observations were made in 14 cases of pernicious anemia, none of which save one showed symptoms or physical findings of a chronic nephritis. Renal function was found disturbed in severe anemia in much the same manner as in chronic nephritis. This disturbance in excretion is probably the result of the anemia, either a toxic or a nutritional disturbance in renal cellular activity, rather than the result of an actual renal lesion. Improvement in renal function with improvement of the blood condition supports this view. Conversely, the author points out that in a case with moderate nephritis with considerable anemia the latter factor might give a picture of renal excretion suggestive of severe nephritis and thus lead to an unjustifiably poor prognosis.

Sellards and Minot,¹ in studying the EFFECTS OF HEMOGLOBIN WHEN INJECTED intravenously, in solution into patients found that:

1. A quantity sufficient to produce a marked hemoglobinuria in the first specimen of urine voided after injection did not produce subjective symptoms in the cases, 13 in number, which developed hemoglobinuria, except in one instance when an unusually large injection was given.

2. As compared with the normal, distinctly less hemoglobin was required to produce hemoglobinuria in patients in whom there was evidence of increased blood destruction, more especially in pernicious anemia, in one case of hemolytic jaundice studied, and a case of infectious biliary cirrhosis.

3. In secondary anemia due to hemorrhage, or in cases in which there was no evidence of excessive blood destruction, as a rule no hemoglobinuria resulted after the injection of amounts which regularly caused marked hemoglobinuria in active cases of pernicious anemia.

4. In the cases studied, the amount of hemoglobin required to produce hemoglobinuria bore no relation to the red blood count, but it did bear a direct relation to the amount of blood destruction taking place within the body.

Hooper and Whipple² have previously³ shown that BILE PIGMENT could be formed FROM HEMOGLOBIN without the agency of the liver. Solutions of hemoglobin, when introduced into the bloodvessels of dogs whose livers had been excluded from the circulation, gave rise to a formation of bile pigment within a space of two hours. It seemed probable that the endothelium was the tissue active in the transformation.

¹ Journal of Medical Research, 1916, xxxiv, 469.

² Journal of Experimental Medicine, 1916, xxii, 137.

³ Ibid., 1913, xvii, 612.

The same observers were able to demonstrate the conversion of hemoglobin into bile pigments when solutions of hemoglobin were injected into the pleural and peritoneal cavities. The change was less rapid than when the substance was injected into the circulation, six to eight hours being the minimum time. Bile pigment, after it had been formed, was more rapidly absorbed from the peritoneal cavity and consequently appeared earlier in the urine. That bile pigments can be formed without direct liver activity is established without a doubt, and mesothelium is probably capable of effecting the transformation of hemoglobin into these substances.

BASAL METABOLISM IN PERNICIOUS ANEMIA was studied by Meyer and DuBois.¹ In a series of 6 cases, metabolism showed a constant increase, only slight in the mild cases but in 2 severe cases ranging from 7 to 33 per cent. above the normal average. The view that a paucity of hemoglobin must seriously impair the oxidative processes of the body, thereby lowering metabolism, is therefore untenable. The increased oxygenation in pernicious anemia is not made possible by an increased combining capacity of hemoglobin for oxygen but by each one of three factors. Normally the supply of oxygen to the tissues is far in excess of the immediate requirement. In anemia, this margin of safety is encroached upon. The other two factors are an increased pulse-rate and, as Plesch² and Mohr³ have shown, an increased output per heart beat. The cause of the high metabolism is to be sought in the increased activity of regeneration and increased requirements because of muscular activity involved in pulse-rate increase and respiratory rate increase with the attendant coöperation of the accessory respiratory muscles.

The authors have gathered from the literature all the reports of calorimetric studies in anemic conditions, and have translated the results into the terms now used in such methods and compared the results with present standards. The basal metabolism shows the greatest increase in the leukemias, 6 and 19 per cent. increases being the lowest figures recorded and 98 per cent. the highest. Secondary anemia usually shows a moderate increase but not as great as in pernicious anemia. Chlorosis alone shows a constant decrease ranging from 0.2 to 19 per cent., in 10 cases, while 3 others show an increase from 7 to 28 per cent.

Pepper and Austin⁴ report **METABOLISM STUDIES IN A CASE OF PERNICIOUS ANEMIA BEFORE AND AFTER SPLENECTOMY**. The patient was an adult with pernicious anemia of a moderate hemolytic type in whom the splenectomy was followed by the disappearance of the discoloration of the skin and by prompt and lasting improvements in the condition of the blood and general health. There was observed, before splenectomy, a slight positive nitrogen balance while after splenectomy there was an increased nitrogen retention fourteen days after operation, and a return to the preoperative balance after one month. The output

¹ Archives of Internal Medicine, 1916, xvii, 965.

² Ztschr. f. Exper. Path. u. Therap., 1909, vi, 526.

³ Ibid., 1906, ii, 435.

⁴ Archives of Internal Medicine, 1916, xviii, 131.

of uric acid, although never exceeding normal limits, showed a decrease of 22 per cent. after operation. The output of iron through the feces, although never above normal, showed a decrease of 40 per cent. after operation. The excretion of urobilinogen and urobilin in the feces before splenectomy was about three times the normal; two months after operation the output was about one-seventh of that before splenectomy.

Dubin and Pearce¹ found on analysis, before and after splenectomy, of the blood of dogs no change in the amount of total fats and unsaturated fatty acids, as expressed by the iodine value. These findings differ from those under similar conditions reported by King² and Eppinger³ who claim a marked increase in total fats, together with an equally definite decrease in the unsaturated fatty acids after splenectomy.

Mayo⁴ observes that in pernicious anemia when there are cord changes, these changes do not disappear after splenectomy, although the condition may be markedly improved.

Since Eppinger was first led to perform splenectomy because of his observations on the increased output of biliary pigments, especially urobilin, in hemolytic icterus and certain cases of pernicious anemia, with a subsequent decrease in output after splenectomy, the study of this phase of the pathology of the anemias has received much attention. Qualitative tests for urobilin and urobilinogen in the duodenal contents were made by Bondi, working under Eppinger. Wilbur and Addis⁵ have shown the superiority of the spectroscopic method, and applied it in the estimation of the urinary and fecal output of these substances. Their work has shown the fecal fraction to be the more important. Schneider⁶ has studied the duodenal contents using Wilbur and Addis's method as applied in urine examination for the determination of the urobilin and urobilinogen content; for bilirubin he used Huppert's method, expressing the values secured on colorimetric comparison with a standard solution by +, ++, or +++.

Normally, the duodenal secretion was found to contain a certain level of bilirubin, occasionally urobilin, but never urobilinogen in considerable amounts. In anemia of chronic gastro-intestinal hemorrhage in which the blood picture may simulate pernicious anemia, the duodenal estimation of bile pigments gave normal values, a point of significance in differential diagnosis. In pernicious anemia and splenic anemia, urobilin and urobilinogen showed a great increase.

The writer tried Schneider's method in two cases; in the one a case of splenomegaly later diagnosed on histological study as Hodgkin's disease of the spleen, there was a definite increase of urobilin and urobilinogen, with bilirubin+++. In the second, a case of APLASTIC pernicious anemia, with no increase in fecal bile pigments as estimated by the method of Wilbur and Addis, the duodenal contents showed *no* urobilin or urobilinogen; bilirubin was ++.

¹ Archives of Internal Medicine, 1916, xviii, 426.

² Ibid., 1914, xiv, 145.

³ Berlin. klin. Wehnschr., 1913, i, 1509.

⁴ Journal of American Medical Association, 1916, lxvi, 716.

⁵ Archives of Internal Medicine, 1914, xiii, 235.

⁶ Ibid., 1916, xvii, 32.

McClure,¹ in reporting 64 transfusions with no deaths in the treatment of 17 cases of pernicious anemia, emphasizes the importance of careful selection of donors according to their iso-agglutinin group and of the systematic frequent repetition of the transfusions. The harmful results and severe reactions in 7 of the transfusions he attributes to such an improper selection of donors. To illustrate the value of frequent transfusion, he cites 2 cases of his series in which good results were thus obtained, the one showing a rise from 1,428,000 to 5,280,000 red blood cells after 13 transfusions of 650 to 800 c.c. each in a period of seven months; the second, a rise from 1,224,000 to 4,736,000 red cells after 10 transfusions of 200 to 500 c.c. each in a period of two months. Finally, as was done in these 2 cases, McClure advises splenectomy after sufficient improvement has been achieved by transfusions, and if, after splenectomy, there is not a rapid improvement in the blood picture, transfusion should be used until the hemoglobin reached 90 per cent., never allowing it to fall below 75 per cent.

Peterson,² in discussing the TREATMENT OF SEVERE POSTHEMORRHAGIC ANEMIA and the hemorrhagic diseases, states that transfusion of whole blood, intramuscular injections of whole blood, and intravenous and subcutaneous injections of homologous serum are the most efficient measures and of value in the order named. In severe cases of acute posthemorrhagic anemia, blood transfusion is the best and, at times, the only efficient means of saving life. The author points out that in some cases of pathological hemorrhage when the blood of one donor has proven ineffectual, the blood of another donor has brought about striking results. The best clinical results have been obtained when the donor is young, healthy, not fully matured.

Krumbhaar³ reviews the reported cases of SPLENECTOMY AS A THERAPEUTIC MEASURE FOR PERNICIOUS ANEMIA in order to determine how valuable this procedure has thus far been in pernicious anemia. In 1913, Eppinger, Decastello, and Klemperer independently applied splenectomy in pernicious anemia. Eppinger adopted this procedure because of the observation after splenectomy of evidences of decreased hemolysis. Decastello, on the other hand, was influenced by the improvement noted after splenectomy in hemolytic jaundice and Banti's disease. Klemperer had noted at times a polycythemia following splenectomy for such conditions as rupture of the spleen. Of the 153 cases collected from the literature by Krumbhaar, 19.6 per cent. died within six weeks; in 15.7 per cent. there was no improvement, while in 64.7 per cent. there occurred distinct improvement clinically and in the blood picture. This high postoperative mortality may have been due to a poor selection of cases, for a much greater proportion of the more recent cases has survived operation. However, of the patients who showed improvement after operation, nearly two-thirds have failed to maintain this improvement, or have died in a relapse or from intercurrent disease. A few have continued in good condition during the period of observation (over two years), but in no

¹ Journal of American Medical Association., 1916, lxvii, 793.

² Ibid., lxvi, 1291.

³ Ibid., lxvii, 723.

case can it be said that cure has been effected. Splenectomy seems not only justifiable, but in many cases advisable, but in no case should a cure be promised, nor should the operation be undertaken save under the most favorable conditions.

The best results are obtained if the operation is preceded by one or more transfusions; indeed, it cannot be decided whether or not the transfusions would have produced equally good results without splenectomy. The best results are to be expected in patients who have not passed the fifth decade, in whom the disease has not progressed for more than a year and who have a relatively good blood picture. Those with enlarged spleens and in whom evidences of hemolysis were more marked have done better than cases in whom the reverse was true. The absence of splenic enlargement, as well as of increased hemolysis, should be considered unfavorable, as should also the existence of spinal cord symptoms or the presence of an aplastic bone marrow.

Lee, Minot and Vincent¹ discuss THE MODE OF ACTION OF SPLENECTOMY AS A THERAPEUTIC MEASURE. They attribute the temporary improvement in pernicious anemia to two factors: (1) A diminution in blood destruction, and (2) an increased activity of the bone marrow. They believe that the stimulating effect of splenectomy is in no way specific for any one portion in function of the marrow, although the effects are seen at different periods of time after the operation. Thus an increase of polymorphonuclear leukocytes is seen almost immediately after the operation. An increase in platelets take place somewhat later, while red blood cell production occurs, if at all, still later. Splenectomy seems to produce the greatest stimulation of the bone marrow of any known therapeutic procedure. The authors do not attempt to explain by what mechanism this increased bone-marrow activity is produced. The course of the pernicious anemia is, however, not essentially altered by splenectomy, and the operation possesses the obvious disadvantage of being able to produce stimulation but once. Transfusion, on the other hand, while perhaps of less constant and less active effect in marrow stimulation, has the great advantages of being simple and capable of being repeated.

Beifield and Barnes² report a case of severe anemia, with fatal termination, that clinically was typically a pernicious anemia, with low red blood count, high color index, and megaloblasts, but which showed a very unusual manifestation in the presence of a constant EOSINOPHILIA. A white blood cell count of 550 on admission showed a differential of 34 per cent. neutrophiles, 13 per cent. lymphocytes, 5 per cent. large mononuclears and transitionals and 47 per cent. eosinophiles. Eleven days later, of 5500 leukocytes, 36 per cent. were neutrophiles, 19 per cent. lymphocytes and 43 per cent. eosinophiles. Twelve days later eosinophiles were 9 per cent., lymphocytes 51 per cent., neutrophiles 34 per cent., and myeloblasts 2.5 per cent., total count 4200. The last count, seventeen days before death, showed 5000 cells, with 16 per cent. neutrophiles, 55 per cent. lymphocytes and 28 per cent. eosin-

¹ Journal of American Medical Association, 1916, lxvii, 719.

² Bulletin Johns Hopkins Hospital, xxvii, 181.

ophiles. Repeated examination of the stools showed no ova. A section from the biceps tendon revealed no trichinellæ. There was present a high-grade pediculosis corporis.

To reconcile this enormous eosinophilia with our present conception of the nature of pernicious anemia, one must assume either a selective and highly anomalous stimulation of the bone marrow, or an extra-medullary origin of the eosinophilic cells.

Parrish¹ reports a case of pernicious anemia in which splenectomy was done. A spleen three times the normal size was successfully removed and the patient was improving when sudden death due to an embolus supervened, twelve days after operation. At necropsy, there were found two accessory spleens, each the size of an English walnut, that had not been observed at the time of operation.

Because of the danger of splenectomy in patients greatly debilitated by blood disease, or in whom adhesions from perisplenitis increase the difficulty in removing the organ, if not making it altogether impossible, it has been suggested that a ligation of a larger or smaller number of splenic vessels might be a simpler and safer procedure in such cases. Troell suggests that, since in Banti's disease and pernicious anemia a complete elimination of the function of the spleen has a favorable effect, then a partial lessening of its function ought also to be beneficial. Clinical reports of cases in which this procedure has been used are meager and in general unfavorable as to the result.

Troell² has conducted a series of experiments on guinea-pigs and dogs in which varying numbers of the splenic vessels were ligated. It was found that cutting off of splenic vessels led by a process of infarction to an anatomical reduction of the spleen specific tissue, an effect in other words equivalent qualitatively but not quantitatively to that of extirpation of the spleen. In the production of such an infarct there was no advantage obtained by ligation of veins; on the contrary, an egress for the decomposition products of the infarct is desirable. Toxic effects were less marked in animals in which no veins were ligated. The two dogs that died spontaneously had been subjected to a ligation of four-fifths of both afferent and efferent vessels. Toxic effects were much more marked in dogs than guinea-pigs, and this difference may find a parallel in the similar relation between dog and man, *i. e.*, man may be more vulnerable than the dog as the dog is more vulnerable than the guinea-pig. This factor would have an important bearing in the clinical application of this operation. The degree of infarction resulting from ligation depended on the relations of the bloodvessels, Troell pointing out that there are large anastomotic channels between the splenic arteries, close to their point of entrance into the splenic substance.

Splenomegaly. When marked splenomegaly is associated with a history of syphilitic infection, or with definitely positive Wassermann tests, Giffin³ points out that the question arises as to the ETIOLOGICAL RELATIONSHIPS OF SYPHILIS TO SPLENOMEGALY.

¹ Illinois Medical Journal, 1916, xxx, 112.

² Annals of Surgery, 1916, lxiii, 88.

³ American Journal of Medical Sciences, 1916, clii, 5

Diffuse non-gummatous hypertrophy of the spleen quite frequently occurs in patients with syphilis. In adults, it is often associated with gummata of the liver or a definite cirrhosis. Splenic enlargement in early syphilis is probably quite common. Wile and Elliott,¹ in a review of 100 cases of early syphilis, found 36 with palpable spleens. This splenic enlargement usually tends to disappear, but may persist longer than any other visceral manifestation. Up to the age of six months, splenic enlargement appears in 40 per cent. of syphilitic babies. Hutchinson² in a report of 22 cases of splenic anemia of infancy (von Jaksch's disease), found 4 with congenital syphilis. Weller,³ in a report of 30 cases of the splenic anemia of infancy, found 8 to be syphilitic. Syphilis in infants may be associated with blood findings similar to those of the splenic anemia of infancy, just as in adults it may be associated with blood findings similar to those of the adult type of splenic anemia.

Gummatous affection of the spleen is very rare, both in children and adults. Still,⁴ in 1897, was able to collect from the literature only 6 cases in children and 21 in adults.

It is well known that syphilitic splenomegaly may persist or recur in spite of the most active antisymphilitic treatment, and the severe secondary type of anemia that is frequently present may not improve with medical treatment. For this reason splenectomy was performed in Giffin's 3 cases, and with good results. He has collected 3 other cases from the literature in which splenectomy was performed, with cure in two instances.

CASE I.—Woman, aged forty. Marked splenomegaly; no hematemesis; severe anemia; red cells 2,950,000; hemoglobin 38 per cent.; white cells 6500, normal differential count. No history of syphilitic infection obtained. Wassermann strongly positive. History of some splenic enlargement since an attack of typhoid at the age of twenty-eight. Antisyphilitic treatment for 6 months without definite improvement.

Splenectomy. Spleen weighed 900 gm.; considerable perisplenitis; diffuse fibrosis with moderate lymphocytosis; adventitia of arteries markedly affected, in some instances amounting to typical gummata; numerous treponemata in vessel walls. Patient in excellent health one year later. Gained 15 pounds. Blood count: 3,552,000 red cells; 80 per cent. hemoglobin; 11,000 leukocytes.

CASE II.—Woman, aged thirty-two. Moderate splenomegaly; anemia: 4,090,000 red cells; 50 per cent. hemoglobin; 6200 leukocytes, normal differential count; liver enlarged and containing palpable gummata; no hematemesis; negative history of lues in both patient and her husband; Wassermann strongly positive; after one month's active anti-luetic treatment there was slight improvement in strength and weight but the hemoglobin remained low and the spleen was not reduced in size. Splenectomy. Spleen weighed 670 gm.; considerable perisplenitis; moderate diffuse fibrosis. Liver showed extensive cirrhosis and typical

¹ American Journal of Medical Sciences, July, 1915, 512, 518.

² Lancet, 1904, i, 1323, 1333.

³ Archives of Pediatrics, 1914, xxxi, 514, 524.

⁴ Transactions of Pathological Society, London, 1897, xlviii, 205, 209.

gumma formation. Eight months after operation patient had improved markedly in weight and strength and the anemia had disappeared.

CASE III.—Man, aged thirty-five years. History of syphilitic infection at twenty-one. Three positive Wassermann tests elsewhere during last two years: negative at time of examination. Moderate splenomegaly; slight anemia: 4,240,000 red cells; 85 per cent. hemoglobin; 4900 white cells with normal differential count. Recurrent hematemesis. Long-continued antiluetic treatment with only partial relief. Splenectomy. Spleen weighed 1050 gm.; general fibrosis, arteriosclerosis, one typical gumma, a few treponemata. Three months after operation patient was in excellent condition with hemoglobin at 90 per cent.

That cases undoubtedly occur, however, in which a luetic history is obtained which seems to have no etiological relationship to the splenomegaly Giffin illustrates by the following case:

Man, aged thirty-five years. Definite history of syphilis with secondaries ten years previous; onset of present illness sudden, with severe hematemesis, six weeks previous to examination; two subsequent hemorrhages; 35 per cent. hemoglobin; red cells 3,410,000; 4900 leukocytes. Marked splenomegaly; ascites. Negative Wassermann. Typical clinical picture of splenic anemia of the Banti type. Splenectomy. Spleen weighed 1030 gm; diffuse hypertrophic fibrosis. Liver at operation was of normal size; showed no evidence of syphilitic cirrhosis.

Giffin concludes that:

1. The syndrome of splenic anemia and Banti's disease may be present in a patient who has had syphilis, in whom it cannot be demonstrated that the syphilis is a definite etiological factor.

2. Cases of marked splenomegaly in which syphilitic cirrhosis of the liver or gummata of the liver are present, or in which repeated positive Wassermann tests together with other evidences of infection are obtained, should be separately classified and studied.

3. Because of the fact that syphilitic splenomegaly with secondary anemia has persisted in spite of active antisyphilitic treatment, splenectomy seems to be advisable in the light of results obtained in the cases above cited.

Joseph¹ reports a case of BANTI'S DISEASE with necropsy findings. The patient, a man, aged twenty-eight years, had had malaria almost constantly for two years until fifteen months before the onset of his last illness. Hematemesis on December 31, 1915, was the first symptom. On January 5, 1916, there was found an enlarged spleen, considerable anemia—2,240,000 red cells, 60 per cent. hemoglobin, 3000 white cells. Subsequently the hematemesis recurred, the patient became more and more anemic, the liver showed signs of enlargement, ascites and some edema of the legs developed, and death finally occurred on April 3, 1916. The Wassermann was negative, as were several examinations for malaria.

At autopsy, the liver, weighing 1575 gm. had numerous grayish nodules raised and in some places umbilicated on its surface. Micro-

¹ Journal of American Medical Association, 1916, lxvii, 1936.

scopically, there was marked thickening of the capsule, a moderate degree of interstitial cirrhosis, an advanced stage of passive congestion, and considerable pigment believed to be of malarial origin. The spleen weighed 765 gm.; capsule and trabeculae showed fibrosis, the Malpighian corpuscles were atrophic, there was marked endothelial proliferation, infrequent areas of focal necrosis and an abundance of greenish-black pigment, presumably malarial. There were found many esophageal varices, one of which had ruptured, and the stomach contained partly clotted blood.

Eberly¹ reports a case of Banti's disease in a woman, aged sixty-three years, the initial symptoms being pain in the splenic region and signs of mucous colitis. On examination, the patient showed emaciation, a bronzed skin, and enlarged spleen and a moderate secondary anemia. After six x-ray treatments over the spleen, there resulted a local herpes zoster which lasted several weeks. After it cleared up the patient was free of pain, but weak. Six months later there developed ascites and edema, hematemesis and tarry stools. After repeated tapplings there was some improvement, with decided decrease in the size of the spleen. However, ascites recurred, and, on the advice of another physician, she was operated on for cirrhosis of the liver, a Talma operation being done. The liver was found to be small and hard, the spleen only moderately enlarged and surrounded by firm adhesions. Death resulted several days later from gastro-intestinal hemorrhages.

Vance,² in reporting a case of MULTIPLE MYELOMATA, reviews the literature on the subject and discusses the nature and origin of the condition.

Since Rustizky's application of the term "multiple myelomata" to a case of primary multiple tumors of the skeleton, there have been described many different types of multiple bone-marrow tumors under this name. There is still uncertainty in regard to the classification of these tumors, although most observers are agreed that they are derived from the blood-forming cells of the bone marrow, and are related to the primary diseases of the lymphatic-hematopoietic apparatus.

The clinical and pathological pictures of the cases described in the literature are very similar. Cases occur most commonly between the ages of forty and sixty, more frequently in males (76 per cent.). They all show involvement of the skeleton by tumors arising primarily from the bone marrow. The bones of the axial skeleton are usually involved, less commonly the skull and extremities. The tumor is confined to the bones, and in only a few instances has it been described in extraskeletal situations; lymph nodes, liver, on the cricoid cartilage. The bones become fragile, giving rise to various deformities; kyphosis, resulting at times in transverse myelitis, bowing of the sternum, fusiform swellings of the ribs, spontaneous fractures. Persistent deep-seated pain and tenderness, referred, as a rule, to the bones involved, are the chief complaints. Secondary anemia develops and may reach an extreme

¹ Journal of American Medical Association, 1916, lxvii, 33.

² American Journal of Medical Sciences, 1916, clii, 693.

degree. The leukocyte count does not vary much from the normal nor have myelocytes been found in the circulating blood.

In bone-marrow formation, the undifferentiated star-shaped cells develop into two primary forms: (1) the fixed supporting cells which link themselves together by long processes, and (2) the spherical "Wanderzellen" or myeloblasts. Later, the supporting cells develop into the osteoblast, osteoclast and the reticular cell of the marrow, while the myeloblasts become differentiated into the blood-forming elements, as the erythroblast, the granulated myelocytes, and the megakaryocyte.

The morphology and genesis of the lymphoblasts is very similar to that of the myeloblasts, but their future development is not, the lymphoblast developing into a single cell form, the small lymphocyte. However, myeloid cells often appear in lymphatic tissues in pathological processes, such as the myelogenous leukemias, and, conversely, lymphocytes occur in the bone marrow in lymphatic leukemia. Such aberrant elements develop probably from cells normally present in these situations, which suggests that the myeloblasts and lymphoblasts are closely related, though not identical.

With these embryological considerations in view, the primary neoplasms may be divided into two main groups: (1) Those taking their origin from the fixed supporting cell of the embryonic marrow; this includes the benign connective tissue tumors, the endotheliomata, and the ordinary malignant sarcomata; (2) those derived from the primary mesenchymal "Wanderzellen," and classified under the title "Primary Diseases of the Lymphatic-hemapoietic Apparatus." These tumors are found only in situations where lymphoid and myeloid tissues are normally present. They are hyperplasias of some single derivative, or group of derivatives, of the lymphoblast or myeloblast at each separate situation, rather than metastases in the sense of the word as applied to sarcomata. In some forms, namely the leukemias, the tumor cells can be demonstrated in the circulating blood, while in the pseudoleukemias this is not the case, a fundamental difference for which there is no satisfactory explanation.

The tumor cells of this group are, for the most part, easily identified, and such tumor can be readily classified. However, certain cases, whose pathological features conform to those of the lymphatic-hemapoietic group, but the embryological status of whose cells cannot be determined, remain unknown quantities. Such are the numerous "plasma-cell tumors."

Multiple myelomata belongs to the lymphatic-hemapoietic group because of the limited distribution of the tumor growth which is confined to the skeleton in all save a few instances, and the marked resemblance of the tumor cells to the different bone-marrow elements. Lubarsh¹ explains the rare cases of extraskelatal myelomata in liver and lymph nodes by suggesting that such tumors were derived from aberrant myeloid tissue present in those places.

¹ Virchows Archiv, 1906, p. 184.

The author divides the types of myelomata described in the literature into five groups:

1. The myeloblastoma, composed of myeloblasts.
2. The myelocytoma, composed of myelocytes containing neutrophilic granulations.
3. The erythroblastoma, composed of nucleated red cells. Ribbert¹ reports the only case of this kind described in the literature. The tumor cells contained hemoglobin, and Ribbert claims that all stages of the formation of the nucleated red blood cells were present in the tumor growth.
4. The lymphocytoma, composed of cells resembling lymphocytes. This type by earlier observers was described as lymphosarcoma or pseudoleukemia confined to the bones.
5. The plasmocytoma, composed of cells more or less resembling the "plasma cell" of Unna and Marschalkó. This last type cannot be regarded as a true myeloma while the nature and origin of the tumor cell cannot be definitely determined.

The author's case does not conform entirely to any of the above. There are two types of cells present, one of which is undoubtedly myeloblastic. The other is smaller, with irregularly staining eosinophilic protoplasm and pyknotic nucleus, and possibly therefore erythroblastic. It was impossible to prove this by demonstrating the presence of hemoglobin in the cytoplasm from the material at the author's disposal.

Bence-Jones albuminuria, while observed in many cases of myeloma, is not pathognomonic, being present occasionally in other bone conditions, such as chondrosarcoma, osteomalacia, myxedema, etc. Of the mode of formation of this body nothing is known.

Gaucher's Disease.—Gaucher,² in describing the first case of the disease named after him in 1882, noted particularly the large pale cells which he considered epithelial in origin. Marchand³ first noted the presence in these cells of a peculiar homogeneous substance that dissolved in alcohol, giving the cells the vacuolated appearance seen in paraffin section. Schultze,⁴ in reporting a case of diabetic lipoidemia associated with marked "Lypoid zellenhyperplasie" of the spleen with almost complete replacement of the pulp by the large pale cells, pointed out that the vacuolated appearance of the cytoplasm was due to deposition of lipid substances, and he suggested that in Gaucher's disease a similar deposition of lipoids was accountable for the vacuolated cells. The presence of these lipoids in Gaucher's disease has since been established by other observers.

Wahl and Richardson⁵ have studied the lipin-content in a case of Gaucher's disease in an infant eleven months of age. The spleen, liver and lymph nodes presented the usual changes, but the unusual feature of the case was the almost complete substitution of the medulla of both suprarenals by the large pale vacuolated cells. They were also present

¹ Centralbl. f. allg. Path., 1904, xv.

² Epithélioma primitif de la Rate, Paris, 1882.

³ München. med. Wchnschr., 1907, liv, 1102.

⁴ Verhandl. d. deutsch. pathol. Gesellsch., 1912, xv, 15.

⁵ Archives of Internal Medicine, 1916, xvii, 238.

in Peyer's patches, in the intestines and thymus, and involved the adventitia of some of the smaller vessels, a process more diffuse than in any case hitherto described.

On the basis of microchemical and quantitative studies, it was found that liver and spleen show not only a marked increase in the lipin-content but also a serious alteration in normal relations of the lipins to each other. Fixed fats were greatly reduced, while the lipoids, such as lecithin and cholesterol, were greatly increased, a lecithin-like substance predominating in the author's case.

They suggest that Gaucher's disease is due to a disturbance of lipid and fat metabolism, resulting in the accumulation of lipid substances in the cytoplasm of the large pale cells that are mostly transformed reticulo-endothelial cells of the spleen, lymph nodes and bone marrow, and the stellate cells of the liver. These cells have the physiological property of disposing of the fats and lipoids, and compromise the "endotheliale Stoffwechselapparat." It is thus a system disease, but involves the hematopoietic organs only secondarily in that they are very rich in the reticulo-endothelial cells. Gaucher's disease belongs to the group of xanthelasmic conditions characterized by more or less diffuse accumulations of lipoids in reticulo-endothelial or in fibroblastic cells, and it represents a more diffuse involvement than the cases of "large-celled splenic hyperplasia" in diabetic lipoidemia.

The case just cited is one of 2 cases of presumable Gaucher's disease reported by Knox, Wahl and Schmeisser.¹ The chief features are the occurrence in infancy; only one other infantile case, that of Niemann² being on record, both cases occurred in the same family and in both the disease ran a fatal course in a short time.

The authors have tabulated the features of the 16 cases of Gaucher's disease previously reported. The condition appears to be more prevalent in the female. Of the 16 cases there were but three males. Most cases have occurred in young adults. The onset is insidious, with vague and indefinite symptoms. A feeling of weight accompanying the abdominal enlargement was usually present. The course is essentially chronic, except in the infantile cases. Splenic and hepatic enlargements are the most constant physical signs. The superficial lymph nodes were moderately enlarged in 10 cases. A yellowish or brownish discoloration of the skin was observed in 11 cases. Secondary anemia of varying degrees, and a constant leukopenia—a minimal count of 500 has been reported—with a normal differential constitute the blood findings. No etiological relationship between Gaucher's disease and syphilis and tuberculosis could be determined. The observation of cherry-red spots in the maculae of one of the cases leads the authors to suggest, in view of the presence of similar large pale cells in the nervous tissues of cases of amaurotic family idiocy, the possibility that the essential degeneration in the latter condition may be of similar character.

Mandelbaum and Downey,³ who also examined some of the patho-

¹ Bulletin of Johns Hopkins Hospital, 1916, xxvii, 1.

² Jahrb. f. Kinderh., 1914, lxxxix, 1-10.

³ Bulletin of Johns Hopkins Hospital, 1916, xxvii, 109.

logical material from the above 2 cases, object to their classification as Gaucher's disease. Gaucher's disease, they insist, is a definite entity, in which, no matter how far advanced the process, the reticular tissue of the hematopoietic organs and the supporting tissue of the liver are the only tissues involved. As for the microchemical studies, the authors deny that lipoids have been demonstrated in the large pale cells of true Gaucher's disease. They were unable to demonstrate any solvent action of alcohol or ether on the substance in these cells. Stains with Sudan III, Scharlach R, Nile blue, neutral red, and osmic acid were all negative. No anisotropic bodies were demonstrable with the polariscope. For these reasons the authors consider that this substance may be of a protein nature. They believe that when neutral fats, myelin substances or anisotropic bodies are found by microchemical methods in the cells of any process resembling Gaucher's disease, the latter disease may be excluded.

Hodgkin's Disease. Yates¹ would classify certain diseases, of which Hodgkin's disease is an example, in a group that he defines as "a non-communicable infectious granulomatous process due to the *B. hodgkini* (or to similar but as yet not differentiated microorganisms), protean in the resultant local (tissue) and general reactions, and therefore in clinical manifestations." In this category, on the basis of the finding of the organism in cultures from glands in the conditions mentioned, he places leukemia, pseudoleukemia, chloroma, mycosis fungoides, Banti's disease, some forms of lymphosarcoma, certain arthritides (in one case of chronic hypertrophic arthritis a positive culture was obtained), mycosis fungoides (one case seen in which culture was positive), and a certain type of recurrent elephantiasis-like cellulitis (one case seen).

Moore² conducted a series of IMMUNOLOGICAL STUDIES ON HODGKIN'S DISEASE. A horse was given repeated injections of a mixture of sixteen strains of diphtheroid organisms isolated from cases of Hodgkin's disease. The serum was shown to contain specific immune bodies evidenced by complement-fixation tests with the same organisms as antigens. Control antigens of staphylococci, diphtheria bacilli, gonococci or control horse sera gave no fixation of complement. Likewise, the immune serum showed an increase of agglutinin and this was more marked when the serum was refined after the manner of concentrating diphtheria antitoxin. Attempts to use the immune serum in the treatment of a few cases of Hodgkin's disease failed because of the severity of the serum reaction.

It was possible to produce immunization of rabbits and monkeys by both subcutaneous and intravenous injection of the organisms.

Complement-fixation tests were made on 10 patients having Hodgkin's disease, the diagnosis being made in nine instances on gland histology. In no case was there fixation of complement with antigens of mixed cultures isolated from Hodgkin's disease. In 2 cases antigens prepared from organisms cultured from the patient's glands gave negative results.

¹ Colorado Medicine, 1916, xiii, 39.

² Journal of Infectious Diseases, 1916, xviii, 569.

Vaccination with these organisms did not increase complement-binding antibodies in the patients.

Complement-fixation tests made on sera from cases of lymphosarcoma, lymphatic leukemia, chronic arthritis and tuberculosis, conditions in which diphtheroids have been isolated, all gave negative results.

There were no demonstrable soluble toxins formed by the organisms when grown in glucose broth.

Warfield and Kristjanson,¹ in support of their view that Hodgkin's disease is one of the group of diseases among which are placed lymphatic leukemia, chloroma, lymphosarcoma, pseudoleukemia, Banti's disease and certain forms of arthritis, report a case that seems to show several of these diseases in combination. The patient, two months after the onset, complained of swollen glands in the neck, axilla and groin. At that time an inguinal gland was removed and microscopically showed a typical picture of lymphosarcoma. The blood count at the time showed 9000 leukocytes with a normal differential. Two months later the glands generally became much increased in size. Liver and spleen were enlarged and easily palpable. Leukocytes were 112,000, and smears showed the features of acute lymphatic leukemia, 97 per cent. of the cells being a mononuclear cell, larger than a small mononuclear, and with a relatively large amount of light blue staining protoplasm. A week later, on the day before death, an axillary gland was removed which histologically showed the recognized picture of Hodgkin's disease. At autopsy, both mediastinal and mesenteric lymph nodes were found enlarged. Bacteriological studies were inconclusive.

Coley² reports the RESULTS OF TREATMENT in 22 cases of HODGKIN'S DISEASE. Assuming that Hodgkin's disease is a type of sarcoma, he believes the same treatment should be applied to this condition as to sarcoma. If the disease is discovered in the early stages when only one or a few glands are involved, extensive and radical removal if possible should be employed, always accompanied by enucleation of the tonsils if enlarged as they are according to Coley the most probable source of primary infection. This should always be followed by post-operative treatment to prevent recurrence. Yates and Bunting have reported 2 such early cases cured by tonsillectomy and x-ray treatment, the patients being well after five years. Of Coley's cases which were variously treated by x-rays, toxins of erysipelas and *Bacillus prodigiosus*, and operatively, 13 cases died, some after temporary improvement; 4 have shown definite improvement, 2 showed no improvement and the result in 2 cases is unknown. One case was treated by Preston, of Ottawa, with bacterial toxins alone. Clinically the case was typically Hodgkin's disease, with involvement of the cervical glands and enlargement of liver and spleen, but no microscopic diagnosis was made. This case showed rapid improvement and has now been well and without signs or symptoms for seven years.

¹ American Journal of Medical Sciences, clii, 222.

² Annals of Surgery, 1916, lxiii, 35.

Smoot and Carrell¹ report 2 cases of Hodgkin's disease in both of which VACCINE THERAPY was employed. In the first an autogenous vaccine of a diphtheroid was used without any effect on the patient's condition, and without delaying of a fatal termination. In the second, gland cultures having proved sterile, a polyvalent vaccine was used. After the first dose there was a reaction, with decrease in size of the glands. Subsequently there were, however, no similar results and this patient also died.

Whittington² reports a case of acute Hodgkin's disease that presents several UNUSUAL AND REMARKABLE FEATURES. The patient, a private, aged nineteen years, because of pain in the feet and legs was reported sick for "frost-bite" occurring in the trenches in Flanders. Temperature and pulse were normal. After a cathartic there appeared severe abdominal pain, elevated pulse and temperature, and vomiting; the appearance of the case suggested peritonitis. For the next eight days there was constant high fever, relatively slow pulse, a leukopenia (3500 white blood cells), some diffuse abdominal tenderness, more marked over a spleen that became gradually enlarged. The patient had not been inoculated against typhoid fever and on the above findings a diagnosis of enteric fever was made, although agglutination tests and urine and blood cultures were negative. During the next three days, however, the temperature came down to normal and remained so for ten days. The splenic enlargement decreased and the general condition was greatly improved. The hemoglobin had dropped 52 per cent. After a five-day elevation of temperature the patient again continued without fever and steadily improved for nine days. Fever, however, recurred and persisted irregularly during the subsequent six weeks until death. Listlessness and increasing pallor, recurrence of pain in the toes and soles of the feet, rapid splenic enlargement were noted. There was progressive anemia, with 35 per cent. of hemoglobin and 3,000,000 cells two weeks before death. A leukopenia with high polymorphonuclear count (3000—80 per cent.) and an absence of eosinophiles persisted until two days before death when the leukocyte count rose to 15,000. Seventeen days before death there was vaguely palpated a mass in the umbilical region, and a week later a gradually increasing jaundice began. Further blood and urine cultures and agglutination tests were negative. Various diagnoses suggested were typhoid fever, splenic anemia, tuberculous peritonitis, kala azar, Malta fever, Hodgkin's disease, congenital syphilis and septicemia. At autopsy, there was found splenic tumor and enlargement of the retroperitoneal lymph glands which pressed on the lumbosacral nerves. There was an enlarged gland in the portal fissure. Sections of spleen and glands showed a picture typical of Hodgkin's disease.

The most notable features of the case were the acute onset with symptoms and signs suggestive of peritonitis; the subsequent remarkable resemblance to typhoid fever, as evidenced by lethargy, quiet delirium, soft slow pulse, "typhoid" tongue, splenic enlargement,

¹ Texas State Journal of Medicine, 1916, xi, 529.

² Quarterly Journal of Medicine, 1916, ix, 83.

leukopenia, supposed "relapses" and diarrhea; the general resemblance to an infectious fever; the relapsing course, with periodicity of signs and symptoms as well as of the pyrexia; finally the entire absence of enlarged external glands. The whole aspect of the case seems to support the view that Hodgkin's disease is due to some infective organism, which in this instance was particularly virulent.

Mellen¹ reports a case as PRIMARY SPLENIC HODGKIN'S DISEASE. The patient, a female, aged seventeen years, was taken ill in February, 1910, with chills and fever and pain in the left side and was in bed for one week. From that time on she had intermittent chills and fever, amenorrhea with vicarious epistaxis. In September, 1910, she contracted a cold, with subsequent pain in the left hypochondrium and persistent cough. On October 25, 1910, when first observed, she had a blood count of 4,500,000 red blood cells, 3000 white blood cells, 90 per cent. hemoglobin and a normal differentiated count. On November 15, 1910 the count was 2,600,000 red blood cells, 800 white blood cells and 60 per cent. hemoglobin. The differential showed a relatively high polymorphonuclear count. There was splenic enlargement, enlargement of the inguinal nodes and left-sided pleural effusion. The patient died on November 30, 1910, twelve days after a splenectomy. Autopsy was performed. The cervical glands showed slight lymphoid hyperplasia. The inguinal glands showed intense lymphoid hyperplasia, endothelial hyperplasia, great increase in stroma, giant cells, but no eosinophiles. Similar changes were found in the bronchial and retroperitoneal glands. In the spleen the pulp was almost obliterated by fibrosis; there were many plasma cells and multinucleated giant cells. The process was evidently an old one. In view, therefore, of the marked changes in the spleen, the evidently more recent changes in the lymph glands, the fact that the first symptom was pain in the left hypochondrium, the author concludes that the disease was primary in the spleen. He considers this case to be the only one of true primary splenic Hodgkin's disease, believing that the diagnosis in 2 other such cases gathered from the literature was purely conjectural since in neither case was an autopsy performed.

Markovitz² reports a case of Hodgkin's disease with two points of interest: The occurrence in a child only three years and three months old, and the picture of onset, the disease beginning seemingly as an acute tonsillitis with a secondary acute lymphadenitis of the neck. The diagnosis was made on microscopic examination of gland sections.

Warfield and Kristjanson³ report a case of HODGKIN'S DISEASE WITH INVOLVEMENT OF THE INTESTINES. Throughout the entire extent of the wall of the small intestine were small and large nodular bodies. There was also a uniform thickening of the intestinal coats. The mesentery showed similar infiltration. The spleen was enlarged, showed round-cell infiltration, giant cells and a great increase in new connective-tissue fibrils and many fibroblasts. Sections from the

¹ American Journal of Medical Sciences, 1916, cli, 704.

² Journal of Medical Society of New Jersey, 1916, xiii, 355.

³ Bulletin of Johns Hopkins Hospital, 1916, xxvii, 24.

intestines showed an intact mucosa, an enormous hyperplasia of the submucous coat and dense infiltration of both muscular coats to the serosa. The infiltrate consisted of mostly typical lymphoid cells and the first impression was that the growth was a lymphosarcoma. There was, however, a proliferation of the reticulum; in places endothelial cells were fairly numerous, and giant cells were scattered throughout. Eosinophiles were few in number. The authors consider it a case of Hodgkin's disease in which the intestine was the portal of entry of the infection.

Scott¹ reports a case of Hodgkin's disease in which there was INVOLVEMENT OF THE STOMACH.

DIABETES.

Experimental. Taylor and Hulton² have studied the LIMIT OF ASSIMILATION OF GLUCOSE. By common consent, rather than by accurate experimentation, the limit on alimentary administration has been set at 200 to 250 gm. on the empty stomach. From this figure downward, the student of diabetes applies the test; from this figure upward the student of the diseases of the ductless glands applies the test.

The authors found glucosuria in 6 of 23 normal individuals after the ingestion of 200 grams of glucose. Of 9 subjects who took 300 gm. only 3 displayed glycosuria. Of 6 who ingested 400 gm., only 2 had glycosuria. In 5 instances 500 gm. were given with the production of glycosuria in but 1. The authors regard 500 gm. as the physiological limit of ingestion except in one who has trained to the test; it is very large in bulk, inclines to nauseate, and apparently the excess is not rapidly absorbed.

Apparently there is no limit of assimilation of glucose in the majority of healthy adults; glycosuria does not follow the largest possible ingestions of pure glucose. Blood-sugar determinations gave no values above the top normal limits.

Rogers³ made observations on the BLOOD SUGAR in a series of 27 cases of diabetes. The patients in general were found to have a higher blood sugar when they were excreting sugar in the urine than when the urine was rendered sugar-free. Sometimes the blood sugar returned to normal under treatment, and this was generally in the milder cases. Usually, however, it remained slightly elevated, the average figure being 0.12 per cent. by the Lewis-Benedict method.

The threshold of sugar excretion varied in different diabetic individuals and in the same individual at different times. That a definite relationship exists between glycosuria and hyperglycemia has been shown. It has also been shown that permeability for sugar on the part of the kidneys plays an important part in the aforesaid relationship. In nephritis or in coma this permeability is greatly lessened, and in these conditions there are obtained the highest blood-sugar values.

¹ Ohio State Medical Journal, 1916, xii, 323.

² Journal of Biological Chemistry, 1916, xxv, 173.

³ Boston Medical and Surgical Journal, 1916, clxxv, 152.

Rogers states that values above 0.3 per cent. are uncommon unless there is marked renal damage. With a raised threshold, it is therefore possible in nephritics to have freedom from glycosuria and at the same time a considerable hyperglycemia. It is in this type of case that blood-sugar determinations can be of practical value.

In uncomplicated cases, by keeping the carbohydrate intake well below the limit of tolerance, as shown by the appearance of glycosuria, it was found that the blood sugar almost, if not quite, sinks to the normal level. Rogers therefore expresses the belief that efficient treatment can be carried out in most instances, using the urinary sugar alone as the therapeutic guide.

From a prognostic stand-point, it was not possible to predict from a patient's initial blood sugar how long it would take him to become sugar-free. Neither was it possible to learn the height of tolerance as forecast by the blood sugar.

Murlin and Kramer¹ studied the INFLUENCE OF ALKALI AND ACID ON THE GLYCOSURIA AND HYPERGLYCEMIA OF PARTIALLY AND TOTALLY DEPANCREATIZED DOGS.

They found that sodium bicarbonate and potassium bicarbonate may be without immediate effect on the glycosuria and the hyperglycemia. Bicarbonate given by mouth to a fasting depancreatized animal may even cause the reappearance of glucose in the urine after it has been "starved out."

On the other hand, there was disappearance of sugar from the urine of a totally depancreatized animal within four hours following the infusion of 300 c.c. of Ringer's solution containing 1 per cent. sodium carbonate. This was not accompanied by an increase in blood sugar. Dilute hydrochloric acid had the opposite effect, increasing the sugar in the urine without causing any effect on the blood.

The retention of glucose in completely depancreatized dogs after the administration of sodium carbonate was not accompanied by any evidence of improved oxidation of glucose. In partially depancreatized dogs that still had some capacity to oxidize glucose, the administration of sodium carbonate or sodium hydroxide with glucose was followed by a greater oxidation of glucose than when either was given alone.

Thus it seems that while sodium carbonate or sodium hydroxide alone cannot restore the lost function to an organism completely deprived of its ability to oxidize glucose, either substance can improve the capacity of the organism as a whole to oxidize glucose when this function is more or less crippled although not completely lost.

The authors suggest that possibly sodium hydroxide or sodium carbonate accelerate the oxidation of sugar, by increasing the permeability of the cell for oxygen or glucose, or for both, or that the union of the alkaline salt with the sugar forms a combination that can be fixed at the surface of the cells and there oxidized. On the other hand, the alkali may act by creating a more favorable environment for the glycolytic action of a cell which still possesses the potential capacity to burn glucose.

¹ Journal of Biological Chemistry, 1916, xxvi, 481, 499, 517.

Murlin and Craver¹ studied the effect of sodium carbonate administered by the duodenal tube in 6 cases of human diabetes, and the results appear to confirm the observations made with partially depancreatized dogs. Owing probably to the more conservative use of the alkali, the urine was not rendered entirely free of sugar, at least not for a whole day; but it was in several instances very materially reduced. The rise in excretion following the alkali leaves no doubt of this effect.

Observations of the blood sugar and specific gravity of the blood showed that there was a true reduction in the percentage of blood sugar by the alkali, independent of any factor of dilution. If this is true, there is little reason to doubt that the alkali may, in man as in the dog, facilitate the actual oxidation of glucose.

All the patients treated felt an improvement. In two, the objective improvement was distinct.

The results with the carbonate were better than with the bicarbonate, and, indeed, the results from the bicarbonate may be rather harmful than good. The authors therefore recommend the normal salt rather than the bicarbonate, and are certain that it can be used intraduodenally up to 1 per cent., with entire safety. However, if it is kept up too long there is possibility of sloughing.

Epstein and Baehr² have shown that in experimental diabetes after pancreatectomy marked CHANGES IN BLOOD VOLUME occur. It is essential to allow for much changes in blood volume in order to obtain an accurate estimation of the variations in the sugar, incoagulable nitrogen and other constituents of the blood.

Hyperglycemia in these animals mounts progressively in the terminal stages because of diminution in the permeability of the kidneys. This furnishes an explanation for the excessive rise in the blood sugar of diabetics prior to the development of coma.

Underhill³ found that the injection of calcium chloride and calcium lactate failed to induce significant changes in the blood-sugar content of normal rabbits. The same was true of subcutaneous injections of magnesium lactate. However, the subcutaneous or intravenous injection of trisodium phosphate and the intravenous injection of sodium carbonate caused at times a marked fall in blood sugar. Magnesium sulphate, if general anesthesia developed, caused a hyperglycemia.

The action of these same substances was observed in the presence of a hyperglycemia produced by epinephrin injection. Calcium salts always increased the output of urinary sugar. Trisodium phosphate caused a marked lowering and shortening of the hyperglycemia and a decrease in the excretion of sugar in the urine. The same effect was produced by sodium carbonate, while magnesium salts intensified the effect of epinephrin upon the blood-sugar content and glycosuria.

Bloor⁴ studied the LIPOID CONTENT in a series of 36 cases of diabetes. In severe diabetes, the blood lipoids were all markedly increased, up to 100 per cent. or more of the normal values. In mild diabetes the lipoids may be normal. In general, the more severe or long standing the

¹ Journal of Biological Chemistry, 1916, xxvi, 289.

³ Ibid., xxv, 447, 463, 471.

² Ibid., xxiv, 1.

⁴ Ibid., xxvi, 417.

diabetic condition, the more marked was the abnormality in the blood lipoids. The high lipid values noted occurred entirely in the plasma, the composition of the corpuscles remaining normal.

In spite of the high values, the relations between the lipoids were practically those of normal individuals, indicating that the fat metabolism was essentially normal.

Cholesterol increased parallel with the fat in diabetic blood, even in severe lipemia. The determination, therefore, of cholesterol in the plasma, a relatively simple process, should give valuable information regarding the lipid content of the blood in diabetes.

There was no definite relation between high blood lipoids and the occurrence of acetone bodies in the urine.

It has long been known that in normal persons the administration of a carbohydrate-free diet causes the development of a moderate ACIDOSIS. Hirschfeld¹ observed the increased ketonuria. Porges, Leimdorfer, and Markovici² found also a reduction of carbon dioxide in the alveolar air. Benedict and Joslin³ demonstrated an increase in the total metabolism during the period of acidosis. As regards the anti-ketogenic action of alcohol, von Jaksch⁴ reports no influence on the acetoneuria of febrile patients, and Hirschfeld⁵ reports similar findings in two non-diabetic patients. Neubauer⁶ reports a marked decrease of acetone excretion in diabetics after the administration of wine representing 65 to 135 grams of alcohol.

Higgins, Peabody and Fitz report their studies of the acidosis produced in three healthy subjects by a carbohydrate-free diet. There was observed the usual lowering of CO₂ tension of the alveolar air, increased urinary excretion of ammonia nitrogen and acetone bodies, and an increased titrable acidity of the urine. Subjectively, the patients experienced malaise, loss of appetite and lack of energy. There was an increased oxygen consumption, a negative nitrogen balance, increased pulse-rate and increased ventilation. Each person lost in weight in spite of the high caloric value of the intake—an average of over 3000 calories per day. The blood sugar fell in each case during the period of carbohydrate-free diet and rose rapidly again to or above normal on resumption of a mixed diet. Alcohol given in doses comparable to those used clinically did not show any antiketogenic action, and its administration was accompanied by an increased oxygen consumption and an exacerbation of the disagreeable subjective symptoms.

Underhill⁷ found that on a diet of oats and corn, containing an adequate supply of carbohydrate, creatin promptly appears in the urine of the rabbit. A marked condition of acidosis, as measured by the hydrogen-ion concentration of the urine, is always associated with this phenomenon. Oats and corn are pronounced acid-producing foods. On the other hand, if a base-producing food, such as carrots, is fed to

¹ *Ztschr. klin. Med.*, 1895, xxviii, 176.

² *Ibid.*, 1911, lxxiii, 389.

³ Carnegie Institute of Washington Publication, 1912, No. 176.

⁴ *Ztschr. f. klin. Med.*, 1882, v, 346.

⁵ *München. med. Wehnschr.*, 1906, i, 791.

⁶ *Journal of Medical Research*, 1916, xxxiv, 263.

⁷ *Journal of Biological Chemistry*, 1916, xxvi, 127, 141.

rabbits with creatinuria, this symptom rapidly disappears as the urine becomes alkaline. The protein content of the diet is without special significance, for on a diet of oats, corn and carrots, creatin fails to appear in the urine, and the reaction of the latter remains alkaline.

The ingestion of hydrochloric acid with the mixed diet caused the appearance of creatin in the urine whose hydrogen-ion concentration was simultaneously markedly increased.

The administration of alkali during the earlier days of starvation of rabbits greatly diminished or completely abolished creatinuria.

These observations would seem to support the hypothesis that there exists a relationship between acidosis and creatin elimination. However, Underhill and Baumann¹ found that the administration of large quantities of sodium bicarbonate was without appreciable influence upon the elimination of creatin during phloridzin glycosuria. It would seem reasonable to assume that the giving of these large quantities of alkali should exert at least some action on creatin excretion if acidosis, that is, alkali depletion, is to be considered as the stimulus for creatin production. The conclusion is therefore forced that more than one factor may govern the mechanism of creatinuria.

The same authors² found that during the period of hypoglycemia and the most marked creatinuria, produced in dogs by the administration of hydrazin, the hydrogen-ion concentration was greatly depressed, even to the point of marked alkalinity.

This relationship of hypoglycemia and alkalis again emphasizes the significance of acid-base equilibrium in the regulation of the blood-sugar content.

Case³ made a röntgenological study of the gastro-intestinal tract, including the gall-bladder in a series of 72 cases of diabetes. In 6 cases gall-stone shadows were seen, and in 26 cases there was evidence of gall-bladder region adhesions. In view of the close relationship between gall-bladder and pancreatic affections, this large percentage of gall-bladder findings in diabetes is highly significant. A number of these patients were operated for the removal of stones or for chronic gall-bladder infection with very satisfactory results, several of the patients becoming entirely sugar-free and remaining so.

The stomach emptied itself with unusual rapidity in the average case of diabetes. Mild cases showed no ileac stasis; in severe cases, however, the ileac stasis was very marked. A majority of the patients showed a low grade of colonic stasis.

Spontaneous diabetes occurring in the dog or other lower animals is of interest on account of its rarity; and when associated with pancreatic lesions, it becomes a valuable link between the experimental diabetes of dogs and the spontaneous diabetes of man.

Krumbhaar⁴ reports such a case occurring in an Airedale bitch, nine years old, after pregnancy and abortion. The symptoms were loss of

¹ Journal of Biological Chemistry, 1916, xxvi, 147.

² Ibid., 1916, xxvi, 151.

³ Journal of American Medical Association, 1916, lxxvii, 858.

⁴ Journal of Experimental Medicine, 1916, xxiv, 361.

weight and excessive thirst. On a general diet, the animal eliminated 60 gm. of sugar per day. At no time was there any ketonuria. In spite of dietary regulations, the animal's condition grew worse; sugar continued in the urine and cataracts developed in both eyes. Multiple abscesses and ulcers occurred on the legs and trunk. Six months after the onset of the first symptoms she was chloroformed at the request of the owner.

The pancreas, grossly normal, showed microscopically, striking abnormalities in the islands of Langerhans. Not only were they scarce, but every island showed degeneration of various kinds. There was extreme hydropic degeneration and exhaustion of granules, involving both alpha and beta cells, but especially the latter, and replacement of some islands by fibrous tissue.

Allen,¹ in an excellent paper, discusses the investigative and scientific phases of the diabetic question and their relations to practical problems of clinical medicine. Unfortunately, the article does not lend itself to abstraction, and the reader is therefore referred to the original.

Occurrence and Etiology.—Iwai² discusses DIABETES MELLITUS AS OBSERVED AMONG THE JAPANESE.

The mildness of the disease among the Japanese as compared with Occidental cases is striking. It is rare (less than 10 per cent. of all cases) that a diabetic patient presents himself with the chief symptoms of the disease, namely, polydipsia, polyphagia, polyuria and emaciation. In most cases the diagnosis is accidental, glycosuria being found in the course of routine urinalysis in other diseases. Polyuria is not marked, daily urine excretion averaging from 1500 to 3000 c.c. Most cases show only traces of sugar. In 11 mild cases the administration of 20 grams of various sugars on an empty stomach in no instance produced glycosuria. Only when 25 grams was given did sugar appear in the urine.

Acidosis is a very rare complication. In one series of 114 cases, only 5 showed acetone in the urine. In 704 cases collected by the author, death resulted from coma in only 11 cases, and in 3 of these uremia was a possible factor.

Infections, on the other hand, are as common among Japanese diabetics as Occidentals. Tuberculosis, carbuncles and chronic nephritis are the commonest causes of death among fatal cases. Cataract is as common as among Europeans. Albuminuria is present in 12 to 15 per cent. of cases.

The incidence of the disease is less among Japanese than western peoples. Cases in males outnumber those in females five to one. Most cases are observed in the forties.

The mildness and smaller incidence of diabetes among the Japanese Iwai attributes to a greater inherent racial tolerance of the Japanese for carbohydrates. This tolerance he found greater among women than men. Amounts of sugar on an empty stomach ranging from 150

¹ Journal of American Medical Association, 1916, lxvi, 1525.

² Sei-I-Kwai, 1916, xxxv, 29, 35, 43, 49, 55, 65, 73.

to 250 grams did not produce glycosuria in a series of 10 normal men, and among women tolerance reached as high as 350 grams.

Fujii observed that the amylolytic ferment in the milk of Japanese women exceeded considerably in amount the ferment in the milk of European women.

Saito showed that the feces of Japanese possessed twice the diastatic power of the feces of western peoples.

These facts Iwai believes may be attributed to a racial characteristic, the result probably of centuries of a diet largely carbohydrate in nature.

Diabetes is, however, on the increase among the Japanese. The chief causes assigned by the author are the growing complexity of modern life, an increasing luxuriousness of diet with an attendant decrease in physical exercise, and, finally, the increased diagnostic ability of the Japanese physicians.

Reed,¹ in an effort to learn something of the PREVALENCE OF DIABETES IN CHINA AND KOREA, sent questionnaires to 150 representative western physicians scattered as evenly as possible in the countries named; 63 replies were received of which 28 reported no cases observed; reliable reports of 207 cases were obtained. In view of the opinions received, Reed concludes that in the predominant class of persons under medical observation in China, diabetes mellitus is less common than in the West. It will, however, be found increasingly prevalent in China as observation is extended more widely to the better classes of society. The course of the disease and its response to treatment are parallel to similar conditions in the West. No evidence is at hand indicating etiological factors different from those in the West.

In a statistical study of the MORTALITY FROM DIABETES MELLITUS IN BOSTON from 1895 to 1913, Morrison² points out that in Boston, as elsewhere, there has been a steady rise in the death-rate from this disease. A death-rate of 7.1 per 100,000 inhabitants in 1895 has risen to 21.3 in 1913. Among the Jews, the death-rate has been relatively very high. The ratio of the number of deaths due to diabetes to the total number of deaths from all causes was 0.018 among Jews and 0.007 among non-Jews. Of a total of 1775 deaths due to this disease during the period investigated, only 11 were negroes. Contrary to the general observation that diabetes occurs more frequently in the male sex, this series contains 958 females as against 817 males.

To account for a rising death-rate from diabetes mellitus, better and more thorough diagnostic methods may be a factor, but only a minor one. The disease keeps pace with the increasing complexity of civilization. It is more commonly found in large cities among individuals and races who are constantly under physical and nervous tension. Quoting Kleen: "With greater intellectual exertion, keener emotions, higher nervous development, more earnest struggle for existence, more urgent demands, a more intense culture, we are bound to find more diabetes mellitus." It is particularly prevalent among Jews, according to Morrison, not because of ethnic peculiarities, but

¹ American Journal of the Medical Sciences, 1916, cli, 577.

² Boston Medical and Surgical Journal, 1916, clxxv, 54.

because a severe environment during many centuries has developed a nervous type easily thrown out of balance.

Greely,¹ in an analysis of 487 cases of diabetes under his observation, found that the onset of the disease occurred in 72 per cent. of the cases after the fortieth year of life. Sedentary habits, and obesity obtained in a similar proportion of the patients. In many, there was a history of excessive food ingestion.

Greely comments that prosperity is one of the most difficult things for the individual or the nation to withstand. The increase in diseases of metabolism, which include diabetes, gout and obesity, goes hand in hand with the increase in physical indolence, emotional excesses and excesses in the consumption of food, at a time of life when physical activity necessarily wanes. These factors, rather than those of physical heredity, are important in the development of diabetes; in other words, the heredity of environment is the most important consideration.

Greely² in an analysis of 614 cases of diabetes mellitus was unable to establish any etiological relation between focal infections found in the patients and their disease.

The occurrence of POSITIVE WASSERMANN'S IN SOME DIABETICS, apparent improvement following the therapeutic use of mercury or salvarsan, the association of glycosuria in children with congenital syphilis, and the same condition in adults with paresis, tabes and other syphilitic affections are reported in recent literature more or less incidentally. Warthin and Wilson³ feel that sufficient consideration has not been given to syphilis as a possible etiological factor. Pathological material studied by them shows that a combined interlobular and interacinar type of pancreatitis, with loss of the islands of Langerhans, is extremely frequently associated with old latent syphilis. In the great majority of cases, the pancreatitis is localized and patchy in character, and more rarely severe and diffuse. Diabetes may be associated with the more marked degrees of syphilitic pancreatitis; in the authors' autopsy service all their cases of diabetes have been so associated. In this connection, they report these cases, 6 in number, in all of which there was histological evidence of syphilis, in 4 of which spirochetes were demonstrated in the myocardium, and in the pancreas in the 1 case in which search was made. On the other hand, a number of cases of syphilitic pancreatitis of similar degree of severity have not shown diabetes. The authors, therefore, think it probable that latent syphilis is the chief factor in the production of the form of pancreatitis most frequently associated with diabetes, but that the diabetes is not always coincident with severe degrees of this type of diabetes.

Walker and Haller,⁴ in the routine examination of 89 cases of diabetes, found 7 with positive Wassermann reactions. The majority of these 7 cases gave a history of syphilitic infection. In 1 case

¹ Wisconsin Medical Journal, 1916, xv, 45.

² Ibid., 1916, xiv, 464.

³ American Journal of the Medical Sciences, clii, 157.

⁴ Journal of American Medical Association, 1916, lxvi, 488.

the diabetes developed six months after a chancre and a secondary rash. Antiluetic treatment caused the Wassermann reaction to become much weaker but never negative, and did not influence the course of the diabetes, which ultimately proved fatal. On repeated tests in the other cases the Wassermann reaction was noted to be uninfluenced whether there was much or little sugar in the blood and urine, and whether or not the patient was in coma. This would refute the claim of some that the presence of a positive Wassermann in diabetes is due to the presence of acidosis in the serum.

In the thirteenth Rush Society lecture delivered at Philadelphia, January 21, 1916, Allen¹ suggests that diabetes might be defined as a specific deficiency of the power of assimilating food. The accumulation of reserves, as when the body gains weight, diminishes tolerance and aggravates diabetes, whereas the reducing of the reserve stores by low diet or by exercise increases tolerance and checks diabetes. Also one kind of food lowers the tolerance for another kind of food; so adding carbohydrate to a diabetic diet may give rise to ketonuria and adding fat may give rise to glycosuria. The history of diabetic therapy consists essentially of the interweaving or alternation of two principles: The restriction of the sugar-yielding elements of the diet, namely carbohydrate and protein, and the diminution of the total caloric value of the diet. A fasting treatment is in harmony with these methods.

Greely² comments on the SUFFICIENCY OR INSUFFICIENCY OF THE PANCREAS AND ITS RELATION TO METABOLISM IN DIABETES. We are all born with different heritages and each organ is destined to have a certain maximum functional power. That this maximal power is far in excess of ordinary requirements, that is, that the normal reserve power is large, is evidenced by the fact that one-eighth of the pancreas after ablation of the remainder of the organ is sufficient to prevent the onset of diabetes. It is conceivable that this normal reserve power may be deficient in some individuals, and in diabetics is insufficient. It is further conceivable that such an insufficiency may be absolute or only relative. Thus a pancreas capable of handling the metabolism of a 60-kilo individual becomes relatively insufficient if that person gains 40 kilos in weight, and, conversely, regains sufficiency when the excess weight is removed. The simultaneous occurrence of diabetes and obesity is a frequent observation. Again, other conditions in which total metabolism is greatly augmented could encroach on the pancreatic reserve power or, if sufficient, render the patient diabetic. The occurrence of glycosuria or hyperglycemia in fever and Graves's disease might be cited as examples.

Conversely, a decrease in metabolic requirements, rest, pancreatic function, and to this can be attributed the good results of a fasting procedure. "Burning the fires low" permits a restoration of pancreatic sufficiency. Greely suggests that the control of glycosuria by opium derivatives may be due to a lessened metabolic activity.

¹ Boston Medical and Surgical Journal, 1916, clxxiv, 319.

² Ibid., clxxv, 753.

Again, the severity of diabetes follows a steadily declining curve as age increases. The curve of basal metabolism coincides exactly with the curve of severity of diabetes, being greatest in infancy and childhood, and least in old age. The severity of a mild case of diabetes is at once increased by the incidence of any accident increasing basal metabolism, such as fever, infection, goitre.

Acidosis.—Woodyatt¹ emphasizes the point that acidosis in diabetes occurs under the same fundamental conditions and conforms to the same general laws which pertain to acidosis in non-diabetic individuals.

It is common knowledge that the so-called "acidosis bodies," β -oxybutyric acid and its two progenors, β -ketobutyric acid and acetone, arise from products formed in the catabolism of fats and proteins, and more specifically from certain of the lower fatty acids.

A fundamental prerequisite for the accumulation in the tissues and subsequent excretion of abnormally great quantities of the acidosis compounds is a relative diminution in the rate of carbohydrate utilization. When, for any reason whatsoever, the rate at which glucose is utilized in the body falls below a certain minimum, relative to the rate of the fat and protein catabolisms, then the acidosis compounds appear in the blood and urine. In speaking of a decreased rate of carbohydrate utilization in this connection, we should have in mind specifically the catabolism of glucose, and think, not merely of an *absolutely* decreased rate of glucose catabolism, but of a diminution *relative* to the existing rate of lower fatty acid oxidation.

According to the work of Zeller and Lusk, six molecules of higher fatty acid require for their complete oxidation the simultaneous utilization of at least two molecules of glucose. One might accordingly say: "When the mixture of metabolites oxidizing in the body contains more than three molecules of higher fatty acid to one of glucose, the body 'smokes' with acidosis compounds like an automobile with too much oil in the cylinders."

During a period of fasting, the cells naturally continue to oxidize foods. Before the fasting begins, the proportion of fat and carbohydrate catabolized are determined roughly by the proportions of fat and carbohydrate in the diet supplied from the outside world. After fasting begins, the proportion of fat and carbohydrate catabolized must be fixed by the proportions in which these stuffs are supplied from the tissues themselves. The cells will be fed with what there is, and the proportions in which they catabolize carbohydrate and fat during starvation must depend in the end on the proportions in which these stuffs have been stored.

It is accordingly clear how, with respect to acidosis, fasting may produce a variety of effects in different individuals depending on how their bodies may assay for fat and glycogen at the time fasting begins.

A person in whom there is no appreciable fat and only a trace of glycogen will necessarily during a fast subsist wholly on body protein. Unless something interferes with the oxidation of the glucose derivable

¹ Journal of American Medical Association, 1916, lxvi, 1910.

from protein, this glucose probably suffices for the complete oxidation of the autogenic fraction of protein. On the other hand, if the body at the beginning of a fast contains a considerable glycogen reserve and also a normal amount of fat, we would expect at first no significant acidosis because there would be at first enough glycogen for the proper burning of the fat. But later, since the glycogen reserves tend to run low sooner than the fat reserves, there would be an increasing preponderance of fat in the metabolism, and hence a rising acidosis. If the fasting were pushed until the fat reserves were also depleted, one might again anticipate a decline of the acidosis.

In diabetics, acidosis develops under exactly the same fundamental conditions. In diabetes, however, owing to pancreatic insufficiency, the maximum rate at which glucose can be oxidized in the body is fixed at some level which is lower than in health. It therefore happens that in the severer cases of diabetes a rate of fatty acid metabolism, which in the absolute sense is not greater than what might occur in health, becomes excessive in proportion to the amount of oxidizing glucose, and so acidosis develops.

In order to check a diabetic acidosis, it is necessary to restore the proper ratio of fatty acid to glucose oxidation by reducing the fatty-acid metabolism to whatever level is fixed by the existing rate at which glucose is oxidizing. In diabetes, protein alone, if metabolized in sufficient amounts, may be productive of acidosis as well as fat, because although protein in breaking down liberates plenty of glucose for the complete oxidation of its own ketogenic fraction, in diabetes not all of the glucose so formed can be oxidized. Accordingly, to check a diabetic acidosis it is necessary to reduce both the protein and the fat metabolism. Fasting, rest and warmth accomplish this.

It would not be expected, however, that in diabetics, any more than in non-diabetics, fasting would always have exactly the same effect on acidosis. If the diabetic patient were emaciated and his body contained little fat, fasting would be equivalent to throwing him on almost a purely protein metabolism; and unless some toxic factor maintained too high a rate of protein metabolism in spite of the fasting, we should not expect a fasting acidosis. If diabetics are very fat it may happen that fasting results in a persistence, even in a sharp increase, of acidosis, as it does with the non-diabetic obese. Diabetics have acidosis about as soon and in about the same degrees as non-diabetics when there is reason to think that they are metabolizing similar mixtures of food-stuffs during the fasting.

As fasting in diabetes frequently leads to a lessening or disappearance of acidosis, by cutting down the amount of fatty acids in the metabolic mixture until even such little glucose as still smoulders in the cells suffices for their complete combustion, so fasting in diabetes might be expected under the same conditions to cause at least some increase of the respiratory quotient. Although the total metabolism is now low, the percentage of carbohydrate entering into it is increased, and there must be consequently some increase of the respiratory quotient.

Horner,¹ in emphasizing the importance of the EARLY DETECTION OF ACIDOSIS, calls attention to certain facts that obtain in precomatose conditions. Among diabetics who are exhibiting no undesirable condition, one finds the urine essentially normal: In other words, an absence of glycosuria and no increase of diacetic acid, β -oxybutyric acid or ammonia. Prior to the development of acidosis there is always a recurrence of glycosuria, and the output exceeds the intake, *i. e.*, there is a negative carbohydrate balance. At the same time the urinary acetone bodies increase, and the carbon-dioxide tension in the blood, and, consequently, in the alveolar air is reduced. While only under appropriate and favorable conditions the above factors may be determined accurately by complicated analyses, yet sufficient information may be gained at the bedside to recognize an oncoming acidosis by the detection of glycosuria, the demonstration of a positive ferric chloride reaction, and the determination of a diminution in the alveolar carbon-dioxide tension. For the latter purpose, the author uses the Fredericia method; Marriott's method is probably the simplest of all when once the standard solutions have been prepared.

Riesman² calls attention to the DIAGNOSTIC VALUE OF THE SOFT EYEBALL IN CASES OF DIABETIC COMA. First described by Krause, in 1903, this sign has been little mentioned by systematic writers. Riesman observed it in 2 of 3 cases. The decreased tonicity is quite marked at times, the eyeball at times being of almost doughy consistency. It has not been observed in acidosis unassociated with coma.

The soft eyeball in diabetic coma is not due to blood-pressure changes; it is also not an agonal phenomenon, for it is not present in persons dying from other causes. The great retention of ketone bodies in coma may have a share in the production of the soft eyeball. By lowering the molecular concentration of the blood, Hertel succeeded in producing a hypotonia similar to that of diabetic coma in man.

McCasky³ reports a fatal case of diabetic coma in which, during the eight days the patient was under observation, there was at no time diacetic or β -oxybutyric acid in the urine. The patient, a woman, aged fifty-three years, had had symptoms for only two months before death. Acetone was constantly present. The ammonia excretion was not estimated.

The principal interest attaches to the absence of Gerhardt's reaction, showing that this cannot be relied upon to exclude impending coma.

Marriott⁴ describes a SIMPLIFIED PROCEDURE FOR THE DETERMINATION OF THE CARBON-DIOXIDE TENSION IN THE ALVEOLAR AIR. The air is collected after a modification of the Plesch method, a simply constructed mask rendering the collection possible with infants and comatose patients.

The carbon-dioxide tension in the sample is determined by bubbling

¹ Boston Medical and Surgical Journal, 1916, clxxv, 148.

² Journal of American Medical Association, 1916, lxvi, 85.

³ Ibid., 1916, lxvi, 350.

⁴ Journal of American Medical Association, 1916, lxvi, 1594.

the air through a 0.01 N solution of sodium bicarbonate containing phenolsulphonaphthalein as an indicator. The reaction of the solution and the corresponding color obtained are functions of the carbon-dioxide tension. The color is compared with that of standard solutions of mixed phosphates containing the indicator, made up in such a way that the tension of carbon dioxide in millimeters may be directly read off. These standard solutions are practically permanent. Slight changes in temperature are without effect on the accuracy of the method.

Its simplicity of performance and the value of this estimation clinically recommend it highly for practical bedside purposes.

Csonka¹ describes a colorimetric method for the quantitative determination of acetone in urine, based on the red color of the alkaline salt of dioxydibenzene acetone, as first used by Frommer as a qualitative test for acetone.

The simulation of diabetes, while probably not of very frequent occurrence, is easier than that of many other diseases because of the lack of objective physical phenomena in mild and uncomplicated cases, and because the urine in such cases presents no characteristic chemical abnormalities aside from the presence of sugar.

According to Blumer,² this simulation may take three forms: (1) the addition to the urine of sucrose; (2) the addition to the urine of glucose; and (3) the production of an artificial glycosuria by the consumption of phloridzin or phloroglucin. Of the last named, there have been no reported cases.

The detection of the simulation depends on the occurrence of some factor which arouses suspicion in the mind of the physician. In soldiers or in cases with a medicolegal bearing, this suspicion is much more likely to be aroused than in ordinary civil practice. The detection of sucrosuria is simple if certain precautions are observed. If the urine is allowed to stand, especially if in a warm place, inversion of the sucrose into dextrose and levulose may occur. In such a case reduction of copper will occur and will throw the physician off his guard, unless he happens to note the great disparity between the degree of copper reduction and the specific gravity of the urine. Thus, in Blumer's case the specific gravity was 1057, Benedict's test showed a copper reduction corresponding to 0.25 per cent. of sugar while the polariscope showed 11.25 per cent. of a dextrorotary substance. After inversion by heat and acid, copper was reduced and the polariscope showed 3.9 per cent. of a levorotary substance.

A patient who is intelligent enough to add glucose to the urine has usually read up the subject and may not only give a typical history, but may even add water to the urine with the sugar to simulate the polyuria. In Abel's and Hoffmann's Karlsbad patient, sucrose was first added to the urine, but the following year she returned with glycosuria, and actually introduced the glucose into her bladder so that catheterized specimens obtained at periods named by her showed a saccharine urine.

¹ Journal of Biological Chemistry, 1916, xxvi, 209.

² Boston Medical and Surgical Journal, 1916, clxxiv, 48.

Catheterization, however, preceded by bladder irrigation, will clear up such a case.

If there is a suspicion that an artificial diabetes is being produced by the consumption of phloridzin or phloroglucin, the isolation of the patient away from possible sources of the drugs in question seems to be the only rational procedure.

Renal Diabetes. Under the term "renal diabetes" is understood a glycosuria the result of an abnormal permeability of the kidney to sugar. For the diagnosis of this condition, Lewis and Mosenthal¹ point out that the data necessary are few in number but sharply defined:

1. A glycosuria maintained at a fairly constant level and not affected by changes in the carbohydrate content of the food.

2. A normal percentage of blood sugar while the urine contains glucose.

The authors suggest, therefore, that the term "renal diabetes" is a misnomer, and that "renal glycosuria" would be more appropriate. Very few cases have been reported which conform exactly to this condition. Most of these have been extremely mild cases in which the renal barrier to sugar was only very slightly depressed. One case only has been reported, the case of Galambos,² in which the threshold was markedly lowered, and conditions resembling a phloridzin glycosuria were found.

The author's case is a mild one, in which an accidentally discovered glycosuria is the only symptom. Repeated blood-sugar estimations gave normal values. A slightly diminished phenolsulphonephthalein excretion and a slight elevation of Ambard's constant above the normal point to a depressed kidney function.

The prognosis in these cases is as yet an unsolved question. It is possible that they remain stationary and be of no importance to the organism as a whole. It is not certain that a renal diabetes may develop into diabetes mellitus. It is possible that the renal threshold may be progressively lowered until the conditions found in phloridzin poisoning obtain. As yet sufficient cases have not been observed to predicate the probability of events.

Riesman³ reports 4 cases of mild diabetes in youthful patients, aged thirteen, seventeen, nineteen and twenty-two years, respectively, 2 of the cases occurring in the same family. In all cases a very moderate glycosuria was almost the only symptom. In all the cases the glycosuria was easily controlled, and 3 patients returned eventually to a normal diet. The fourth had attained a tolerance of 90 grams of carbohydrate when last seen. The author considers these cases as in the category of renal diabetes, described by Klemperer, Lépine, Frank and Salomon, a condition with mild glycosuria, rarely over 20 grams per day, and little influenced by the ingestion of even large amounts of carbohydrate.

Prognosis and Treatment. As Foster⁴ points out, prognosis bears a close relation to treatment in diabetes as in all chronic diseases. If we

¹ Johns Hopkins Hospital Bulletin, 1916, xxvii, 133.

² Deutsch. med. Wchnschr., 1914, xl, 1301.

³ American Journal of the Medical Sciences, cli, 40.

⁴ Ibid., 1916, cli, 176.

are to advise patients intelligently with maladies such as chronic nephritis and diabetes, we must form a very clear estimate in each case as to just what are the dangers which menace his existence. The two goals of therapeutic endeavor, prolongation of life and the amelioration of symptoms, are secured but seldom by a change in the individual; not infrequently by a change in the environmental demand. This is particularly applicable in diabetes, for with this disease more than with any other the afflicted is out of joint with his environment.

Infections rank first among the dangers that beset the existence of the diabetic. A slight cold becomes a very serious complication with a diabetic child; tonsillitis that would scarcely confine a healthy adult to the house has killed many diabetics. The only safety is in keeping the patient in some condition approximately to normal vigor so that infective agents find a less fertile soil. One must therefore be frankly pessimistic for that group of cases that can attain and preserve a sugar-free urine only at the expense of nutrition.

That the average diabetic not only has more comfort and sense of well-being but that his actual resistance to infection is higher when he is sugar-free is undoubtedly true. However there are certain cases in middle life with severe glycosuria, not complicated by acidosis, and in whom undernutrition and loss of strength are the striking features. In some of these cases on a diet that controls the glycosuria the patients remain some 20 per cent. under weight, while with a diet that holds them but 10 per cent. under weight they have about 15 grams of sugar daily in the urine. Which is the preferable condition? It is doubtful whether in our present state of knowledge we can answer this question. A factor that must be considered is that in patients in which the glycosuria is entirely controlled there still develop at times nervous lesions, renal conditions and the like. The question of hyperglycemia, a blood sugar above the normal but below the threshold value of the kidneys must therefore be held accountable. Therefore in the treatment of ordinary cases, the ends to be obtained are not only a sugar-free urine, and an absence of acidosis, but a blood sugar as near normal as possible.

To prognosticate from the degree of hyperglycemia or the severity of acidosis in a given case whether that particular case is going to be mild or severe is not generally possible. Some of the profoundest cases of acidosis with extremely high blood-sugar content in youthful individuals at times clear up with astounding rapidity. A much better opinion can be based on the duration of the disease. Cases may be divided therefore into early and advanced, with a much less favorable prognosis in the latter group.

In a consideration of the FASTING TREATMENT OF DIABETES, with special reference to acidosis, Stillman¹ suggests that, according to their behavior while fasting, cases may be divided into four types. Any given case may react differently to fasting on different occasions. The classification is based on the study of acid production as determined by blood bicarbonate content and urinary acid excretion.

¹ American Journal of the Medical Sciences, 1916, cli, 505.

Group I consists of cases which maintain a normal bicarbonate reserve of the blood throughout treatment. These are the milder diabetics, easily rendered sugar-free and developing no untoward symptoms during the fasting period. In these cases the therapeutic indication consists in the adaptation of a diet to their tolerance to keep them sugar-free.

Group II comprises cases which during the fast recover from an acid intoxication which is sometimes so severe as to verge on coma. These cases are frequently acute in course, with high glycosuria and ketonuria and a low bicarbonate blood reserve. These patients should be fasted till sugar-free.

Group III includes cases with a low-grade acidosis before, during, and after their fast—the most difficult group to treat successfully. One may suspect that a patient belongs in this group from some or all of the following signs: Chronicity of the diabetic symptoms; lessened mental acumen; lessened physical alertness; tendency to a low grade but continuous glycosuria; low carbohydrate tolerance; a certain degree of obesity; persistent lipemia; lessened sodium bicarbonate reserve in the blood; a slight but extremely obstinate ketonuria. In these cases the fasting period required to clear up glycosuria may be long, and during this time the urine may not become negative for ketones and the blood may maintain its subnormal bicarbonate reserve. In these cases the secret of success lies in a continuous subcaloric diet, with fast days interpolated twice a week. Even though the loss of weight may appear excessive, it is not to be feared. Not infrequently months of treatment are necessary to obtain good results. Eventually, these patients show an increased tolerance for carbohydrate, the urine is free of ketones and the blood alkali normal.

Group IV comprises the cases which develop signs and symptoms of acidosis during the fasting period, though previously no evidence of acid intoxication may have been shown. The hidden danger of impending acidosis may be marked by their apparent state of good health and nutrition. On the second or third day of the fast, vague symptoms, with irritability, may appear. Then symptoms become intensified and nausea may develop or drowsiness supervene. Should fasting be continued still longer, hyperpnea or vomiting, indicating the onset of coma, may occur. During the development of these symptoms, even though the urine may sometimes gradually become clear of sugar and the ketone reaction remain slight or only mildly positive, the analysis of the bicarbonate of the blood shows an increasing tendency toward the danger zone. Thus urinary tests for acidosis are often misleading in that they are indicative merely of the excretion of acid bodies and not a true index of their accumulation. On the other hand an analysis of the blood bicarbonate, as determined by the power of the plasma to combine with carbonic acid, offers an accurate measure of the degree of acidosis present. In these cases fasting should be discontinued. On a low protein-fat diet the symptoms of acid intoxication may disappear after the first feeding. After several days of such diet, a second fast has always been, therefore, well tolerated and has cleared up the glycosuria successfully.

Joslin,¹ with Brigham and Horner, has analyzed 14 cases of diabetes mellitus unsuccessfully treated by fasting. In the light of later experience, the author concludes that at least 8 of these deaths might have been avoided or deferred. The cases are presented in four groups.

Seven cases are listed under "incomplete treatment." In 3 of these the treatment was incomplete at the start, because they were not fasted sufficiently to cause the persistent absence of glycosuria. Consequently, being sugar-free for only one or two days, the course of the disease was not markedly influenced. In the fourth case the sudden abandonment of treatment shortly after the expiration of fasting, contrary to the advice of the physician in attendance, was responsible for death. Complete lack of supervision after leaving the hospital was responsible for the death of another. In 1 case treatment was discontinued by the physician in charge of the patient after leaving the hospital. Death followed six weeks later. In the seventh case the danger of a sudden change to a protein-fat diet in diabetes of short duration was illustrated. The patient, a child two years and two months old, developed signs of coma within twelve hours after his last meal, which was taken four hours before entering the hospital, where he was seen for the first time.

In group II intercurrent infections played an important part in the death of 2 cases. A gangrenous appendix in an elderly fat man was the primary cause in 1 case, though the ether anesthesia, which was the secondary cause, was of equal significance. The therapeutic lesson taught by this case was that morphin should not precede anesthesia in diabetes. In this instance, $\frac{1}{4}$ grain of morphin given subcutaneously preliminary to operation so reduced the respiratory excursion that nitrous oxide was a failure, and one had to resort to a prolonged ether anesthesia. In the second case multiple carbuncles and abscesses were responsible for death. The interesting observation was made in this case that while receiving large doses of sodium bicarbonate the patient showed a fairly constant weight and a low sugar output. After the soda had been stopped for a number of days, there was observed a loss of an average of 3.5 pounds daily over a period of eleven days, with, at the same time, an increase in sugar and nitrogen excreted. The authors ask the significant questions: Does the mere retention of fluid in the body lead to the retention of carbohydrate? Does the retention of fluid in the body lead to a better utilization of carbohydrate? Is the reverse of these two propositions true? Might it not be possible, by a series of experiments designed to increase the content of water in the body, to throw light upon the capacity of the body to store carbohydrate? May not rapid changes in the weight of severe diabetic patients be an early guide to approaching coma?

In a third group is placed a single case of long duration. Changes in diet and régime of patients who have suffered from diabetes for many years are always dangerous, and particularly so with the cases of extraordinary length. In the patient in question the duration of the disease

¹ Boston Medical and Surgical Journal, 1916, clxiv, 371, 425.

was twenty-nine years and unusual apprehension was consequently felt. Fasting for nine days failed to rid the urine of sugar, and on the ninth day the quantity of dextrose in the urine was 17 grams, and the diet contained but 8 grams of alcohol. During the succeeding four days the patient took very little food—a few eggs, lean meat, orange, a little oatmeal, and death occurred thirteen days after admission to the hospital. This case constitutes a distinct failure.

And yet inspection gives good ground for belief that death might now be prevented. In the first place, the urine output after the fifth day increased in amount, and it is here again significant that with it rose the nitrogen. With the increase in the quantity of urine there was no increase in acidosis as shown by the ammonia, and the carbon-dioxide tension of the alveolar air did not change materially during the whole period. There was no great change in the quantity of sugar excreted. The dextrose-nitrogen ratio at the beginning—1.85 to 1—apparently afforded no index whatsoever of the severity of the disease. Two features, however, claim attention; the change in weight from 132 to 122 pounds in ten days, and the low excretion of salt. The administration of sodium bicarbonate temporarily halted the progressive loss of body weight. When compared with the preceding case, the suggestion is striking that the addition of large quantities of salt to the diet might have led to the retention of body fluid and interrupted the downward course of the patient. The retention of body fluid, which often goes hand in hand with the "oatmeal cure," may be one of the chief advantages which have been ascribed to that "cure." The liberal use of broths during the early days of fasting may be helpful in that they contain considerable quantities of salt and prevent loss of body weight.

The remaining 4 cases occurred in patients with complications independent of diabetes. In one there was a high blood-pressure, mitral insufficiency and a history of Graves's disease. In another, death followed forty-one days after the removal of a cancer of the bladder, which recurred in the rear of the incision. Arteriosclerosis in one, and syphilis with coincident vigorous antileptic treatment in another, were causes of death.

Allen and DuBois¹ studied the effects of the OATMEAL TREATMENT and the fasting treatment in a series of 6 cases of diabetes by means of the respiratory calorimeter.

No special influence of oatmeal in diabetes or special readiness of oxidation of this form of carbohydrate was demonstrable. The behavior of the respiratory quotient showed no important difference on the first day and on the third day of the oatmeal treatment.

Even in the severest type of diabetes the active symptoms may be eliminated by prolonged fasting. The observations in the respiratory calorimeter prove that patients as a result of the fasting acquire the power of oxidizing sugar derived first from their own body protein, and later from the protein and carbohydrate of a carefully regulated diet.

¹ Archives of Internal Medicine, 1916, xvii, 1010.

The results of two respiration experiments in a severely diabetic patient showed that mild exercise slightly raises the respiratory quotient, and this suggests the possibility that exercise may improve carbohydrate utilization.

According to comparisons of the surface area as calculated by the linear formula, increase above the true normal level was generally absent or slight. During fasting the metabolism fell markedly to 20 per cent. below normal.

It is generally accepted that the glycosuria following phloridzin administration is accompanied by a hypoglycemia, differentiating it from clinical forms of glycosuria in which there exists a hyperglycemia. It has been believed that phloridzin specifically affects the renal cells, either to increase their permeability to blood sugar or to excite them to secrete dextrose, since the injection of the drug into the renal artery is immediately followed by glycosuria, and since no decrease in blood sugar occurs in phloridzined animals in whom the renal arteries or ureters have been tied. Pearce,¹ however, has observed that pancreatic and gastric juice and sometimes the salivary juice, fluids which in normal dogs contain no appreciable amount of reducing substance, do show a reducing substance in dogs rendered glycosuric by phloridzin. In the case of the pancreatic juice he has shown this to be dextrose. The methods by which phloridzin makes the kidney cells, and the cells of other secreting glands permeable to sugar are, no doubt, alike but the fundamental nature of the action is still unknown.

Joslin² reports a MORTALITY of 11.7 per cent. in 314 cases of diabetes under his observation during the year ending May 1, 1916, as compared with a mortality of 15 per cent. in 211 cases of the preceding year, representing a decrease in mortality of about 20 per cent. Joslin says these figures are particularly encouraging in view of the fact that in one-half of the 37 fatal cases seen this last year death might have been deferred if the methods of treatment now in general use had been employed. In a study of the causes of death in 408 cases of the author's series, it was found that 66 per cent. died of coma, that 87 per cent. of all those who succumbed during the first year of the disease died of coma, and that this was the case in 100 per cent. of the fatal cases in children. Therefore, if the mortality of diabetes is to be reduced, our energies should be directed first toward the avoidance of coma, because the treatment of coma is so unsatisfactory; and second, particular attention should be exercised in the management of cases of diabetes in the first year following the disease. Furthermore all cases should be persistently followed up, and the good effects of treatment not be allowed to lapse by indifference or neglect.

Joslin³ has analyzed the *causes of death* in cases of diabetes seen by him *in private practice*. Of a total of 945 cases seen in twenty years, 425 have died. Of these, 147 died without coma. These he classes in six groups. The first group of 16 cases comprises miscellaneous and

¹ American Journal of Physiology, xl, 418.

² Boston Medical and Surgical Journal, 1916, clxxv, 147.

³ American Journal of the Medical Sciences, 1916, cli, 313.

uncommon causes, such as pernicious anemia, suicide, accidental death, etc. In a second group cancer was responsible for 17 deaths. Pulmonary tuberculosis was the cause of death in the 16 cases of the third group. As regards this complication, Joslin believes that the medical profession has been altogether too pessimistic. When the treatment of the diabetes is faithfully carried out, these patients do quite well. The trouble in the past has been that consumption was usually advanced when diagnosed. In a diabetic, temperature, pulse and respiration give no clue to the diagnosis and the loss of weight is attributed to the diabetes. Diagnosis in these cases is often aided by a careful study of the family history and an x-ray examination.

A cardiorenal and vascular group includes 62 cases. Cardiac decompensation, angina pectoris, chronic nephritis, cerebral hemorrhage are some of the conditions. The average age at death of these patients was sixty-four years. Modern treatment with restricted feeding should prolong the life of these individuals.

Thirty-six cases died as a result of infections. The advent of an infection lowers the tolerance of a diabetic for carbohydrate and thus increases the severity of the disease. Pneumonia, with 15 cases, heads the list. Tonsillitis is second with 11 deaths.

Coma was fatal to 273 cases, thus causing two-thirds of the deaths. Since coma must now be considered, not a justifiable, but in most cases an avoidable, accident, a closer scrutiny of these coma deaths is instructive. In the first place *ether anesthesia* is a burden which a light case of diabetes may bear easily, which may change a moderate to a severe case, and to a severe case may be fatal. Diabetic patients with *impaired kidneys* are peculiarly susceptible to coma because the power of elimination of acid bodies is impaired. *Infections* have already been alluded to. One fact stands out in this respect: The number of procrastinating cases of mild infections in mild diabetics, chiefly in the lower extremities, which frequently prove fatal. Handicapped by a lingering infection only too often allowed to continue for months, with kidneys less efficient, deprived of exercise, these patients often meet a fourth enemy in ether anesthesia. It is known that if a diabetic patient has gall-stones to be removed, he instantly commands the services of the leading surgeon on the senior staff; but if a diabetic patient has a sore toe there is no house officer too young to dress it until a few weeks later, if the patient survives that long, the surgeon in the amphitheatre amputates the thigh.

Geyelin and Du Bois¹ report a case of diabetes of maximum severity in which there eventually occurred marked improvement. On admission to the hospital, the patient, a student, aged nineteen years, then in the sixth week of the disease, showed, during the first twenty-four hours on a complete fast, an output of 74.9 gm. of glucose, 27.9 gm. of urinary nitrogen, a D:N ratio of 2.68, 43.7 gm. of β -oxybutyric acid, a blood CO_2 of 30.4 mm. tension and a blood sugar of 0.313 per cent.

During an initial three-day fast, the severity of the acidosis increased.

¹ Journal of American Medical Association, 1916, lxvi, 1532.

The fat metabolized by the patient was practically all used in the formation of β -oxybutyric acid.

On the subsequent low diet, the patient showed an output of glucose that could have been derived only from protein. For a considerable period the dextrose of the urine bore the ratio to the nitrogen of the urine of 3.61 to 1, indicative of the total inability of the body to oxidize sugar.

There was an excessive protein waste over a long period of time. During seven days the urinary nitrogen remained over 30 gm. per day, on one occasion there being an output of 38.28 gm. in twenty-four hours, the highest figures heretofore observed in man.

The highest figure of β -oxybutyric acid output in a day was 87.38 gm.

After seven days of low feeding the patient was again fasted, and this time steady rapid improvement occurred. Sugar disappeared from the urine in ten days. The urinary nitrogen steadily fell, reaching 10.5 gm. on the tenth day, while on the following day the β -oxybutyric acid output was 0.241 gm., and the blood sugar on the same day was 0.195.

The respiratory quotient on one day during the low-diet period was 0.687. During the period of recovery there was an extraordinary rise similar to that found in convalescence from typhoid fever, there being two observations of 0.915 and 0.860 respectively. At the same time the total metabolism was greatly diminished, a low figure of 25.4 calories per square meter per hour, linear formula, being reached. Consequently the increasing tolerance for carbohydrate allowed the patient to derive a large percentage of calories from sugar.

The patient's weight dropped in three months from 57.4 kg. to 48.3 kg.

On discharge, three months after admission, he was sugar-free. The blood sugar was normal, 0.081 per cent. The diet contained 90 gm. of carbohydrate and had a total caloric value of 2559.

In its clinical course this case is somewhat analogous to an acute infection, as suggested by the rapid onset, severity of symptoms and subsequent regaining of a high food tolerance.

Laboratory observations bear out the complete analogy to the severest form of experimental diabetes, which in animals has always proved fatal. Also the few patients with uncomplicated diabetes recorded as having a D : N ratio of 3.6 : 1 have died.

Barringer¹ reports 3 cases of mild diabetes in which graded SYSTEMATIC EXERCISE increased considerably the carbohydrate tolerance, at the same time improving the general state of health and strength. While contra-indicated in severe types of the disease in which it lowers the tolerance and may even precipitate coma, exercise in mild cases, if carefully controlled, is a valuable therapeutic measure that has been neglected.

Williamson² publishes six recipes for HOME-MADE BREAD substitutes

¹ American Journal of the Medical Sciences, cli, 181.

² British Medical Journal, 1916, ii, 870.

for diabetic patients. For want of space they cannot be given here, but the reader is referred to the original article. Williamson has found them very satisfactory, palatable and comparatively cheap and easily prepared.

He urges that diabetic patients should not try one bread substitute only. They should not cease to use all diabetic breads should the first one tried be unpalatable. But they should be allowed to try only reliable diabetic breads—those which the medical man has found from his own testing to be satisfactory.

A simple rough test may be done as follows: Drop a little of the following solution on the out surface of the diabetic bread: Iodine, 1 gr.; potassium iodide, 1 gr.; water $\frac{1}{2}$ oz.; a deep blue-black coloration is produced if the bread contains much starch. This simple test is sufficient to show that a large number of the very palatable cheap (?) diabetic breads are loaded with starch, and therefore unreliable, unless they be regarded as practically the same as white bread and taken in the same limited quantities.

Gout.—In discussing the DIAGNOSIS AND CLINICAL CHARACTERISTICS OF GOUT, Pratt¹ aptly quoted the words of William Heberden as written in his *Commentaries* in 1782: "The gout affords a striking proof of the long experience and wary attention necessary to find out the nature of diseases and their remedies. For though this distemper be older than any medical records, and in all ages so common; and besides, according to Sydenham, chiefly attacks men of sense and reflexion, who would be able, as well as willing, to improve every hint which reason or accident might throw in their way; yet we are still greatly in the dark about its causes and effects, and the right method in which it should be treated."

The greatest confusion exists in the minds of many practitioners today regarding this disease and its diagnosis. In some parts of the country the diagnosis is frequently made in conditions that are not gout; thus arthritis deformans, even in typical cases, is mistaken for gout. In other localities, as Pratt puts it, "there seems to be a skepticism in the minds of many practitioners regarding the existence of such a disease."

One of the chief reasons for the wide-spread misconceptions regarding the symptoms and signs of gout is the rarity of the disease in this country. Further, totally erroneous ideas have prevailed until comparatively recent years in our medical teachings. Thus, many physicians still hold the false belief that an increased output of uric acid in the urine or the formation of the pink or lateritious deposit is characteristic of gout.

In the diagnosis of the disease Pratt calls attention to the suddenness of onset of the acute attacks, the predilection for involvement of the great toe, the intensity and extreme painfulness of the local inflammation. In chronic gout, the x-rays may aid in diagnosis. There may appear small dark areas, circular in outline, with clear sharp, borders

¹ Boston Medical and Surgical Journal, 1916, clxxv, 925.

in the epiphyses of the affected joints, especially the fingers, due to the absorption of bone from areas in which sodium urate has been deposited.

The urine of a gouty patient when on a purin-free diet shows a uric acid output that is often low in the interval between attacks, but rarely below the limit of normal, 0.3 gm. per day. For a day or two preceding an acute attack there is a fall in the uric acid output below the usual level. This is followed by a marked rise early in the attack.

The uric acid in the blood is usually notably increased in gouty individuals in the intervals as well as during the attacks. This is particularly true after ingestion of purins after having been on a purin-free diet. In this respect the sweat-bread meal has proved of aid in diagnosis.

The prompt relief from pain produced by colchicum is in itself a therapeutic test of diagnostic value.

Pratt¹ has studied the *uric acid in the blood* of 16 cases of *typical gout*, of which 11 were previously reported. The average amount of uric acid irrespective of diet or condition of the patient was 3.7 mg. per 100 c.c. of blood. Seven patients examined when free from symptoms and on a mixed diet showed an average of 4.3 mg.; 6 patients on a purin-free diet, examined when they had no acute manifestations of gout, showed an average of 3 mg. Thus there was more uric acid in the blood when on a mixed diet than when on a purin-free diet. Gouty cases on the average showed twice as much uric acid in the blood than non-gouty cases.

On a purin-free diet, the average amount was larger during an attack than during the interval—in the former 4.3 mg., in the latter 2.4 mg. The same relation obtained irrespective of diet, 4.6 mg. being the average during an attack and 3.3 mg. during the interval.

The diagnosis of gout may not be based solely on the finding of a hyperuricemia, for high concentrations are also found sometimes in other joint conditions; but in these the hyperuricemia is transitory while in gout it is usually constant. Thus a case of infectious arthritis showed on one examination 7.6 mg., while seven months later on a mixed diet there was only 0.8 mg. per 100 c.c.

In the cases studied no relation could be traced between the amount of uric acid in the blood and the severity of character of the disease. Two patients had many large deposits of sodium urate beneath the skin in various places, yet on a purin-free diet they showed 2.4 mg. and 2.2 mg., figures lower than the average in gout. In one case of gout two observations two years apart showed 1.7 and 1.3 mg., the lowest amounts yet recorded in gout, and both well within the limits of normal.

Exogenous protein ingestion in the form of a sweat-bread meal did not produce an increase in blood-uric acid in 4 non-gouty patients. Observations before the meal averaged 2.1 mg., and twenty-four to

¹ American Journal of the Medical Sciences, 1916, cli, 92.

forty-eight hours after the meal averaged 2.2 mg. However in 5 gouty patients there occurred a marked hyperuricemia twenty-four hours to three days after the meal, the average figure being 5.1 mg.

These observations indicate that uric acid derived from exogenous purin does not accumulate in the blood unless there is a disturbance in the uric acid metabolism.

Fine¹ studied the URIC ACID CONTENT OF THE BLOOD in 7 cases of early interstitial nephritis. In the presence of practically normal urea nitrogen and creatinin figures there were elevated uric acid values quite comparable to those found in a series of 5 cases of typical gout in symptomless intervals.

Fine, therefore, urges that an early nephritis must be ruled out before making a diagnosis of gout on the finding of a uricemia alone.

He raised the questions: Is gout merely a stage in the development of interstitial nephritis whose further progress may be indefinitely delayed? Is early interstitial nephritis merely potential gout, in which the clinical symptoms may or may not eventually appear? Is the uric acid retention of gout due to the specific condition, *gout*, or to a complicating early interstitial nephritis?

Haskins,² in an investigation of the URIC ACID SOLVENT POWER OF NORMAL URINE, found that many urines that are slightly acid and all that are neutral or alkaline when shaken with uric acid for twenty minutes at 37° C. take up extra uric acid. Dilute urines, when considered in proportion to their concentration, showed much greater solvent power than less dilute urines. Some urines dissolved so much uric acid that they came to contain more uric acid than is present in a saturated solution of monosodium urate. In all probability, in these cases at least, part of the uric acid is in colloidal solution.

Haskins³ studied the *uric acid solvent power of urine after administration of various drugs*. Piperazin can cause the urine to dissolve more uric acid than it would without the drug, and this effect is most marked if sodium citrate or bicarbonate be also given and if diuresis be avoided. Lysidin can act as a uric acid solvent, but is not a practical therapeutic agent because of the large doses required. Lithium carbonate is a uric solvent if large doses are used, but is unsafe and possesses no advantage over sodium citrate or bicarbonate. Sodium citrate and bicarbonate are reliable and satisfactory uric acid dissolving agents when given in such dosage as to keep the urine alkaline.

Foster⁴ summarizes the facts bearing on the METABOLISM IN GOUT in this way: The uricemia is not due to abnormal production of uric acid, neither is it due to defective destruction; it may be due to defective excretion. From this it is evident that the disease is due primarily to a defective renal function. The retention of uric acid is not peculiar to gout but is more pronounced with this disease. Due to unknown conditions, a deposit of urates from the blood into cartilage occurs.

¹ Journal of American Medical Association, 1916, lxvi, 2051.

² Journal of Biological Chemistry, 1916, xxvi, 205.

³ Archives of Internal Medicine, 1916, xvii, 405.

⁴ New York State Journal of Medicine, 1916, xvi, 539.

Why this phenomenon does not occur commonly in nephritis but does occur with gout is unknown.

Rosenbloom¹ studied the calcium and magnesium metabolism in a case of chronic gout and found it to be normal in character.

Chace,² in discussing the treatment of gout, points out the AIM OF TREATMENT as twofold: The prevention of uric acid formation and the facilitation of its elimination. The patient should avoid a sedentary life and should take light exercise. Care of the skin is essential; baths, with friction rubs, massage, and an occasional Turkish bath are useful.

The dietetic treatment is based on the estimation of the patient's ability to eliminate exogenous uric acid, his endogenous excretion of uric acid having been previously determined by observing uric acid excretion while on a purin-free diet. A daily output of less than 0.35 mg. of uric acid of endogenous origin establishes, according to Chace, the diagnosis of gout. The best results are obtained by giving a well-balanced diet, particular care being taken to maintain the patient's strength, and keeping the purins within the patient's eliminative capacity. A purin-free day should be interposed at frequent intervals. The intake of sodium chloride should be limited, because sodium salts, according to the author, favor the deposition of urates in the tissues.

Coffee, tea and cocoa, because of their purin content, should be used sparingly, if at all. Alcohol and condiments, because of irritative action on the kidneys, should be avoided. Water should be taken freely. Saline mineral waters rather than alkaline mineral waters are advised, as the latter favor the deposition of uric acid in the tissues.

Finally, of the drugs, atophan above all, colchicum and the salicylates facilitate uric acid excretion, and a periodic purging of the organism with courses of these drugs over two or three days are advised. Lithium does not have any value in this direction.

Scurvy. Jackson and Moore³ were able to produce EXPERIMENTAL SCURVY in guinea-pigs by diets of pasteurized, raw, boiled, skimmed and condensed milk, streptococcus broth and milk, milk and green vegetables, thyroid extract and milk, casein and water. The addition of calcium lactate to milk or the injection of calcium lactate into guinea-pigs on a milk diet did not prevent scurvy. A cream diet and a diet of olive oil added to the milk did not prevent scurvy.

Mixed broth cultures of *Streptococcus viridans* and *Streptococcus hemolyticus*, water, lactose water and lime water did not produce scurvy.

In a series of 6 guinea-pigs fed on goat's milk for over forty days, no symptoms of scurvy developed.

In guinea-pigs fed on milk the clinical symptoms were preliminary loss of weight, swelling of the wrist and knee-joints, occasionally of the costochondral junctions, ankle and elbow-joints, and occasionally hyperemia of the gums, with dulness of the lower incisors. Fractures

¹ American Journal of the Medical Sciences, clii, 256.

² New York State Journal of Medicine, 1916, xvi, 537.

³ Journal of Infectious Diseases, 1916, xix, 478.

of the long bones near the epiphyseal ends were common; fragility of the bones was more or less marked.

The average time for the onset of symptoms was nineteen days. The disease was afebrile and produced no great increase in leukocytes.

The chief pathological lesions noted postmortem were hemorrhages, which were found in the muscles, bone marrow, more frequently at the ends of diaphyses, tooth pulp, costochondral junctions and occasionally in the skin and lymph glands; enlargements of the ends of the long bones; swollen lymph glands.

Microscopically, the earliest lesions observed were slight amounts of necrosis and hemorrhage, the only evidences of inflammation being slight fibrin formation and the presence in surrounding tissues of mononuclear and polymorphonuclear eosinophile cells. Small infarct-like lesions were also found early in the process.

Jackson and Moody¹ made bacteriological studies in guinea-pigs in which scurvy had been thus produced. Cultures of crushed tissue resulted in the isolation of a diplococcus of low virulence and with a tendency to form chains.

Pure strains of these organisms inoculated into the circulation of guinea-pigs and rabbits living under ordinary conditions gave rise, in most instances, to hemorrhagic and other lesions in the bones, joints, muscles, lymph glands and gums.

Streptococci of the same type as those injected were recovered from the lesions in these animals as late as forty days after a single intracardiac or intravenous injection.

When animals which had artificially received these streptococci in the circulation had their resistance kept high by proper feeding, the lesions produced did not have the same tendency to progress that was seen in animals receiving an unbalanced diet.

Cultures of the heart blood from the affected guinea-pigs were sterile, and passage of blood from an affected animal to a normal animal failed to produce the disease.

Hess² urges that, although pasteurized milk is to be recommended on account of the security which it affords against infection, we should realize that it is an incomplete food. Unless an antiscorbutic, such as orange juice, the juice of orange peel or potato water is added, infants will develop scurvy on this diet. This form of scurvy takes some months to develop and may be termed subacute. It must be considered not only the most common form of this disorder, but the one which passes most often unrecognized. In order to guard against it, infants fed exclusively on a diet of pasteurized milk should be given antiscorbutics far earlier than is at present the custom, even as early as at the end of the first month of life.

In the course of development of infantile scurvy, growth, both in weight and in length, is markedly affected. Under these conditions weight ceases to increase and a stationary plane is maintained for weeks or for months. On the administration of orange juice or its

¹ *Journal of Infectious Diseases*, 1916, xix, 511.

² *American Journal of Diseases of Children*, 1916, xii, 152.

equivalent, however, there is a quick response, indeed supergrowth is frequently manifested.

Measurements showed that growth in length is also retarded during the protracted development of infantile scurvy. This is of greater biological interest, as simple malnutrition usually does not affect this function in the infant. In this particular, supergrowth also follows the addition of the essential foodstuff, showing that the growth impulse has remained uninjured and has merely been held in abeyance.

West¹ warns against the error not uncommonly made of mistaking scurvy in infants for rheumatism. While superficial observation may show much similarity between the lesions of scurvy and rheumatism, a careful examination in scurvy cases will show that the lesions present are not in the joints at all. Rheumatism is not a disease of infancy, and it is a pretty safe rule that the diagnosis of rheumatism in a child under two years is a mistake.

Tyson and Jump² report a case of adult scurvy in which there was marked pyorrhea, the pus containing a large number of amebæ. On antiscorbutic treatment the scurvy promptly cleared up, and at the same time the pyorrhea ceased. Only one ameba could be found after prolonged search. It was concluded that the amebæ bore no etiological relationship to the scurvy, but that, being normally present in the mouth, they found during the disease a favorable environment for growth.

¹ Southern Medical Journal, 1916, ix, 861.

² Pennsylvania Medical Journal, 1916, xix, 507.

OPHTHALMOLOGY.

By EDWARD JACKSON, M.D.

Ciliary Ganglion Anesthesia. The ciliary ganglion is situated about 16 mm. back from the entrance of the optic nerve to the eyeball and 9 mm. in front of the optic foramen. It is a little to the temporal side of the optic nerve, and may be above it or below it. It was demonstrated some years ago,¹ in the attempts to excise it for the purpose of curing glaucoma, that it was difficult to find in the living subject, even by the most careful dissection. Recently the injection of anesthetic solutions in the region of the ganglion has been resorted to as a means of producing anesthesia of the whole eyeball.

In view of the fact that the ganglion is only 2 or 3 mm. long, and one-half as wide and thick, it is probable that the fluid injected very rarely enters it, and doubtless it is better that it should not be penetrated by the needle. But the immediate region where the ciliary nerves come off from the ganglion, and other sensory nerves are in close proximity, has been proved the best point at which to produce anesthesia by nerve block. The region anesthetized cannot be so extensive as that affected by injections into the apex of the orbit through the sphenomaxillary fissure.² But it does generally produce anesthesia of the whole eyeball, and often to a considerable extent of the accessory structures. The failures and incomplete successes are easily explained by failure to properly place enough of the solution used. Gradle,³ using this method for 146 enucleations and exenterations of the eyeball, reports complete anesthesia in 125. In 13 others the operation was successfully done under this anesthesia, but not without severe pain. In 8 cases it was necessary to give inhalations of ether to complete the operation.

After instillations of cocaine in the conjunctival sac, a needle, 5 cm. long, is entered near the outer canthus so as to pass horizontally along the upper border of the external rectus. It is kept at an angle of 20 degrees with the median plane of the head, until it has passed the equator of the eyeball, where it is turned to an angle of 40 degrees with the median plane and thrust forward until the tip touches the inner wall of the orbit. He uses 2 c.c. of a 1 per cent. solution of novocaine. In addition, some of this solution, or one of cocaine, must be injected subconjunctivally below the cornea because the nerve supply of this part does not come from the ciliary ganglion. While the needle is being thrust forward, a small amount of fluid should be expelled to anesthetize the tissues penetrated. Five minutes are allowed to elapse before beginning the operation.

¹ PROGRESSIVE MEDICINE, June, 1893, p. 396.

² Ibid., June, 1916, p. 447.

³ Archives of Ophthalmology, 1915, vol. xlv, p. 270.

Illig¹ recommends, for this purpose, a solution of

Novocaine	0.0125
Potassium sulphate	0.02
Suprarenin (1 to 1000)	gtt. ij
Sodium chloride (0.9 per cent.)	5.0

Of this he injects $2\frac{1}{2}$ c.c., a part of it from the external canthus and part from above the caruncle. The needle is thrust in until it has entered the tissues for 3 or 3.5 cm. He waits twelve to fifteen minutes after the last injection, and finds any subconjunctival injection unnecessary.

Elschnig,² who suggested this method of anesthesia several years ago, calls it the ideal method of anesthesia for enucleation and exenteration of the eye. But it must be borne in mind that it is not to be used for eyes that possess useful vision, or may be expected to regain useful vision. The point of the needle might easily be thrust into the sheath, or the substances of the optic nerve, thus destroying any hope of sight.

CONJUNCTIVA AND CORNEA.

Causes of Acute Conjunctivitis. The work of connecting the well-observed clinical characters of acute conjunctivitis, with the new bacteriological observations regarding it, has been referred to in former years, and is still going on. Three important papers upon it have appeared in the past year. Butler³ has reported upon 200 cases of acute conjunctivitis in Jerusalem from which smears were examined. MacGillivray⁴ has reported on the bacterial fauna of the conjunctiva in the region of Dundee, Scotland, including 539 acute cases. MacCallan⁵ has given, in tabular form, the results of 7784 examinations made in Egypt. As the latter points out, the satisfactory classification of conjunctivitis may prevent inaccurate diagnosis and loose thinking. He recommends recognition of four classes of acute conjunctivitis based on bacteriological causes. These causes are (1) gonococcus, (2) Koch-Weeks bacillus, (3) Morax-Axenfeld bacillus, and (4) cases due to other organisms. MacGillivray finds the diplobacillus of Morax-Axenfeld the most common cause, and after that the Koch-Weeks bacillus, a reversal of what has been observed in other Scotch cities—Glasgow and Aberdeen.

The relative frequency of the different classes in these three localities may be shown thus, the figures for Jerusalem covering the period from January to June:

	Cairo.	Dundee.	Jerusalem.
Gonococcus	43.6	2.2	8.4
Koch-Weeks bacillus	19.5	11.9	8.3
Diplobacillus	16.6	31.9	18.3
Pneumococcus	5.4	8.2	18.3
Mixed infections	3.9	10.0	16.7
All others	4.2	19.5	10.0
Negative	6.8	16.3	20.0

¹ Archiv f. Augenheilkunde, 1915, vol. lxxx, p. 54.

² Zeitschrift f. Augenheilkunde, 1915, vol. xxxiv, p. 207.

³ Ophthalmoscope, 1916, vol. xiv, pp. 60, 134.

⁴ Royal London Ophthalmic Hospital Reports, 1916, vol. xx, p. 175.

⁵ Bulletin of Ophthalmological Society of Egypt, 1915, p. 37.

When we compare these statistics with those obtained in other parts of the world¹ and note such facts as that the Koch-Weeks bacillus is very rarely found in the western half of the United States, it becomes evident that the geographical distribution of the causes of conjunctivitis is extremely important.

One might suppose that the prevalence of gonococcus conjunctivitis in Palestine and Egypt was dependent on some social condition. But ophthalmia neonatorum is not more common there than in other countries; and in both these countries venereal disease is comparatively rare. The mass of cases occur in older children, say two years of age. But the striking thing about the gonococcus cases in Egypt is that they grow rare at certain seasons and common at others. In Egypt, in January, February, and March, MacCallan records 29 cases; in April alone, 60; in October, 648; in December, 192. With the exception of a slight drop in August, there is a regular curve, with a minimum in March and a maximum in October. A somewhat similar curve is shown for Koch-Weeks and diplobacillus infections, although with variations less pronounced. These show a minimum in February and March and maximum in June and September, with a more decided drop in the curve for August.

In Jerusalem, it is the Koch-Weeks bacillus conjunctivitis that shows great seasonal variations. Its frequency during the first six months of the year has been shown, in the above table, to be 8.3 per cent. But, during June, it begins to be more common, runs rapidly up to a maximum in August, and then decreases in frequency to the minimum in April. Such is the seasonal character of the disease, that for the last six months of the year, which Butler calls the "epidemic period," it causes 66 per cent. of all cases. To a much less degree, pneumococcus disease also becomes more frequent during this period.

Evidently the causation of conjunctivitis is closely associated with climatic conditions. Experience in the cases occurring in a certain locality and of their seasonal prevalence is still as valuable for practical purposes as bacteriological observations. But the combination of such experience with a knowledge of the bacteria present gives a decided advantage over either alone. It is interesting to note that in Egypt a routine treatment is still employed after the bacteriological examination. The eyes are to be carefully washed, and the palpebral conjunctiva painted with a 2 per cent. solution of silver nitrate. After this the discharge is prevented from accumulating by washing with an antiseptic solution. When the diplobacillus of Morax-Axenfeld is present, this solution contains zinc sulphate 1 to 200. For all other cases it contains potassium permanganate 1 to 5000.

Of Palestine, Butler remarks "no reason can be given for the large amount of ophthalmia. All the conditions of the near-East—the dust, dirt, heat, flies, and the general lack of sanitation—are to be found elsewhere unaccompanied by either trachoma or ophthalmia." He thinks flies are important agents, but experiments in Egypt have not done much to confirm this view. In Cyrenaica, adjoining northern

¹ PROGRESSIVE MEDICINE, June, 1906, p. 335.

Egypt on the west, Nasr Farid¹ reports that acute conjunctivitis is rare, although four-fifths of the inhabitants suffer from trachoma.

Ophthalmia Neonatorum. The rarity of this disease in Egypt, in spite of the frequency of gonococcus conjunctivitis, has been referred to above. Williams and Rosenberg² found that many cases of purulent conjunctivitis in the infant seem to be contracted not at birth but later. Of 47 cases from which cultures were taken, all showed the staphylococcus, and 42 the xerosis bacillus. In 22, there were organisms of the pneumococcus-streptococcus group. In 12, the gonococcus was found, and in the same number the Koch-Weeks influenza bacillus group was represented. In 9 cases of the influenza and streptococcus groups, other members of the family, or the nurse, were found to have suffered from "colds."

As of possible gonococcus origin were regarded 20 cases in which the gonococcus was not found, but might have been present earlier. They conclude that in at least one-third of all cases, purulent conjunctivitis in the infant is due to organisms other than the gonococcus; and this fact should make physicians more ready to report this class of cases to the health authorities. In this series, 3 cases presented corneal complications that might have caused blindness. In all of these the gonococcus was found. It is of interest to note that 77 per cent. of these cases, including all that presented corneal complications, had received "prophylactic" treatment. The proportion of infants suffering from purulent conjunctivitis was 8 in 1000 births.

Swimming-bath Conjunctivitis. Under this title various epidemics of conjunctivitis have been described in Germany and in this country. Apparently the cases arise from contagion. Gradle³ reports his observations on 18 cases, and suggests the title "swimmers' conjunctivitis," as 4 of them had been swimming in Lake Michigan and not in any indoor tank. If the view of a contagious origin be correct, it is evidently a contagion that spreads freely in fresh water, and might be contracted at a crowded lake beach.

It starts in one eye, but often involves both. There is moderate photophobia, a small amount of secretion, and moderate swelling of the lids. There is marked swelling and redness of the conjunctiva, with roughening of the palpebral portion. Under treatment, the symptoms improve within a week, and it assumes a subacute form with gradual improvement to recovery in about three weeks. Various bacteria were found in Gradle's cases, but no form common to all, that might be taken as the cause. Scrapings of the conjunctiva before treatment were stained with the Giemsa stain, and always showed the cell-inclusion bodies that have been associated with trachoma. But these rapidly disappeared after applications of silver nitrate. Gradle found the best treatment consisted in instillations of a 1 per cent. solution of silver nitrate daily, and of a 10 per cent. solution of argyrol, three or more times a day. While the early appearances of the eyes somewhat resemble

¹ Ophthalmoscope, 1916, vol. xiv, p. 148.

² Archives of Ophthalmology, 1916, vol. xlv, p. 109.

³ Ophthalmology, 1916, vol. xii, p. 634.

those of trachoma, rapid recovery clearly distinguishes this disease from trachoma.

Vernal Conjunctivitis. This condition has been subjected to about all kinds of topical applications that are ever made to the conjunctiva. Occasional apparent cures¹ have followed several of them, but nothing has proved generally serviceable. Generally this condition continues to plague the patient from year to year, worse in the hot season, and sometimes quite relieved by cool weather. Butler² has now reported 2 cases in which permanent cure seems to have followed applications of *radium*. In one case, 45 mg. of radium bromide in a tube was applied for four minutes. The application was repeated after three weeks, after that a third application of three minutes was made. In the other case, two plaques covered with a varnish of radium bromide, 7 mg. each, were applied from eight to fifteen minutes, one time daily for three times, and later twice in one day, seven applications in all. Sir MacKenzie Davidson, who made the application in these cases, states: "That all cases that he has treated with radium have been cured completely of the characteristic symptoms," and he recommends it as a specific for vernal conjunctivitis.

Trachoma. The diagnosis of trachoma is often difficult, several writers in the past year having referred to this fact. Heath³ believes that many cases reported as trachoma are not of that character. But as the contagiousness of any case depends principally on the discharge, the practical rule in school inspection is to isolate and treat all cases that present discharge. Mild cases without discharge may be permitted to attend school.

Allport⁴ has prepared a digest of State legislation regarding trachoma in eight States that have such enactments. In twenty-three other States, trachoma is classed as a contagious disease; but in seventeen States no laws exist regarding it. Prophylaxis must accompany treatment of the individual case, and should include: Abolition of the common towel; wash basin, soap, and drinking cup; admission of all possible fresh air and sunlight to buildings; avoidance of overcrowding; rubbing the eyes after touching door-knobs, stair-railings, books, etc. When much trachoma exists, schools for trachoma scholars should be established; and trachoma hospitals and dispensaries maintained in trachoma districts.

Parinaud's Conjunctivitis. This has been usually regarded as a distinct clinical entity; but Rolandi⁵ believes it is not. He reports a case as belonging in this class which he thinks was demonstrated to be tuberculous in character. Cultures of the bacilli obtained presented most of the characteristics of the bovine type, but in some respects resembled the human type. He has collected 111 cases from the literature. Generally but one eye is involved, although in 7 cases both were affected.

¹ PROGRESSIVE MEDICINE, June, 1916, p. 451.

² La Clinique Ophthalmologique, 1916, vol. xxi, p. 469.

³ Indianapolis Medical Journal, 1916, vol. xix, p. 190.

⁴ Ophthalmology, 1916, vol. xii, p. 494.

⁵ Annali di Ottalmologia, 1915, vol. xlv, p. 544.

The involvement of the lymphatic glands always occurs; generally in this order: first, the preauricular, then parotid, submaxillary, and cervicals. In 2 cases there seemed to be a morbid process extending to the whole lymphatic system. In 32 cases the glands suppurated, while in 44 the swelling disappeared without suppuration. The duration of the disease may vary from two months to two years. The characteristic lesions in the conjunctiva are the large granulations, which may give rise to sessile or pedunculated masses. More rarely, they are true ulcers with excavated margins. Generally the cornea escapes.

Ipecac Conjunctivitis. Since the breaking out of the present war rather frequent attempts to avoid military service have been made, by inducing conjunctivitis by placing powdered ipecac in the conjunctival sac. In most cases it has been induced in one eye only. The conjunctiva of the lower cul-de-sac is inflamed, red or salmon color, with chemosis, and in some cases granules which resemble trachoma. Fromaget and Harriet¹ conclude from experiments that the inflammation is due to the chemical irritant, emetine. Aubineau² points out that the rise is due to an absence of conjunctival secretion, an eczematous appearance of the lid borders, and a condition resembling lardaceous degeneration in the conjunctiva of the lower lid.

Kalt³ has described a method of detecting the remains of the powder even when present in very small quantities. A piece of gun-cotton, the size of a pin-head, is held in forceps and rubbed in the lower cul-de-sac, about the caruncle, and along the edge of the lids and roots of the lashes. It is then dried and dissolved in one part alcohol and two parts ether. The film left on evaporation is removed in water and examined under the microscope. It is stained with Gramm's iodine solution, which colors the starch grains blue-black, and the woody débris yellow. The starch grains are small and characteristic, most nearly resembling those of rice.

Poison-ivy Conjunctivitis and Keratitis. Swelling of the lids, so that the eyes are kept closed, is often one of the worst hardships in a case of rhus poisoning. In a case reported by Sherer,⁴ besides the dermatitis of the lids, the conjunctiva became violently inflamed. It was reddened, swollen, and chemotic; minute punctate hemorrhages were discernible, but no purulent secretion was discharged. Lacrimation, photophobia, and blepharospasm were present, with severe pain. After a week, when the more painful conditions had begun to subside, minute gray dots, from 0.5 to 1.5 mms. in diameter, appeared in the cornea, first near the lower limbus, then near the upper, but not invading the center of the cornea. There was a pericorneal zone. The iris, kept well dilated by atropine, was not damaged. Flushing with boric acid and daily applications of silver were made. Hot applications and free use of morphine controlled pain.

Keratitis Due to Bad Teeth. Seven cases of this sort are reported by Blum,⁵ who believes they are trophic in character, being due to irrita-

¹ *Annales d'Oculistique*, 1916, vol. cliii, p. 388.

² *Ibid.*, p. 349.

⁴ *Ophthalmic Record*, 1916, vol. xxv, p. 191.

³ *Ibid.*, p. 245.

⁵ *Ibid.*, p. 389.

tion reflected back from the Gasserian ganglion. Four of these cases had their bad teeth extracted, and promptly recovered from the corneal disease from which they suffered. One patient, a man, aged forty-five years, refused to have the teeth removed, and continued to suffer from an interstitial keratitis. One patient was relieved by treatment of the corneal lesion, but the next year had a relapse, and the year after that another. Then the carious teeth were extracted and one week later the cornea was well, although it remained anesthetic a year after. This continued anesthesia of the cornea was noted in other cases.

Deep Pustuliform Keratitis. Under the name *keratitis pustuliformis*, Fuchs¹ describes 16 cases in which the corneal lesion begins with gray lines or gray spots deep in the parenchyma. These later develop to yellow, pus-like infiltrates, each surrounded by a gray halo which fades into diffuse opacity of the whole cornea. As a rule, the disease begins with iritis and severe inflammation, swelling and discoloration of the iris with posterior synechia, exudate in the pupil, and hypopion always present. In only 2 cases did the spots ultimately disappear. In all, there was great reduction of vision, which was permanent, most of the eyes retaining only light perception, and some becoming absolutely blind. Four of the eyes were examined microscopically. The lesions were worse in the posterior layers, diminishing forward. In only 1 case was an organism found in the hypopion, *Staphylococcus albus*. Fuchs believes that different exciting causes produce this clinical picture. Nothing in the patients' histories threw light upon the causation. Most of the patients were over fifty years of age, and all but one were men. No special modification of treatment of suppurative keratitis is suggested.

Treatment of Suppurative Ulcers. Ulcers of the cornea are especially accessible to treatment by HEAT STERILIZATION. For many years the use of the actual or galvanic cautery, to the point of destruction of the superficial tissue, has been one of the methods of last resort to limit the disease process.

Of late years, milder applications of heat have proved equally effective.² Wessely,³ experimenting with live steam furnished by an atomizer and conducted through a metal tube, found that cauterization by steam caused much less opacity of the corneal scar than followed the use of the electrocautery. He also claims, from experiment on the corneas of rabbits, that following the galvanocautery the possibility of infection commences after two hours and increases for days. But after steam cauterization the chance of infection diminishes until at thirty hours the possibility seems abolished. Wessely has also experimented with the vapor of boiling alcohol, which seems to accomplish the same result, although acting at a considerably lower temperature.

Prince⁴ describes, under the name "Pasteurization," the method of Weekers of sterilizing the ulcer by holding the heated cautery close to

¹ Graefe's Archiv f. Ophthalmologie, 1915, vol. xc, p. 13.

² PROGRESSIVE MEDICINE, June, 1911, p. 366; June, 1912, p. 363; June, 1914, p. 430.

³ Archiv f. Augenheilkunde, 1915, vol. lxxx, p. 1.

⁴ Ophthalmic Record, 1916, vol. xxv, p. 177.

it. He has had an egg-shaped cautery mounted on a handle for the purpose. This is heated red hot, the eye is cocaineized, the lids separated, and the eye turned so as to bring the ulcer to the middle of the aperture. The pointed end of the cautery is then held three-sixteenths of an inch from the ulcer until it cools. Young¹ has resorted to hot air, obtained through the heated tip of the "cavity drier" used by dentists. But he points out that if the ulcer is deep this treatment may relieve pain promptly, but does not check the disease process. It is better first to make a crucial incision, raise the flap and gently scrub the cavity with cotton tightly wound on a toothpick. The cotton may be moistened with carbolic acid. After the scrubbing, the hot-air application reaches the tissue that is just being invaded and destroys or lowers the vitality of the invading germs.

Although a great deal of work has been done on the VACCINE AND SERUM THERAPY of pneumococcus ulcers of the cornea, but few reports of the practical success of the treatment have been published. Ethylhydrocuprein seemed to have rendered such treatment unnecessary and unwise; but, on account of the war, it has become very difficult, or impossible, to get that drug, and renewed interest is again felt in other means. In a case reported by Marple² the cornea had been struck by a piece of marble causing a central ulcer 3 mm. long, infected by the pneumococcus. This ulcer had been cauterized by the actual cautery and treated with pure carbolic acid, but extended and grew worse with hypopion. Pneumococcus vaccine was given subcutaneously and pneumococcus serum instilled every hour, and, later, 10 minims injected subcutaneously. After forty-eight hours the hypopion disappeared, and the ulcer ceased to increase. Its repair was uninterrupted.

Keratomalacia. It is well-known that keratomalacia is a disorder of nutrition and closely associated with malnutrition. Goldschmidt² has studied it experimentally by observing the effects of undernourishment in white rats. He was thus able to produce a condition of the cornea that corresponded both clinically and anatomically to keratomalacia in infants. By feeding the animals, so affected, with raw, skimmed milk, the condition was quickly cured. He believes this curative action was not due to the albumin, fat, carbohydrate, or salts, but to the ingestion of substances of unknown character necessary to the nutrition of the cornea. Apparently, the etiology of keratomalacia is closely related to that of scurvy and beriberi.

Tattooing of the Cornea. This is sometimes required, when vision has been lost, to lessen the unsightly appearance of a large corneal scar. As a means of improving vision, by lessening the amount of diffused light admitted to the eye, it has been wisely given up. The objections to tattooing the cornea are the possibility of starting an inflammation that may result in sympathetic disease of the better eye; and the fact that tattooing must be repeated every few years to keep up the desired color.

¹ Ophthalmic Record, 1917, vol. xxvi, p. 25.

² Archives of Ophthalmology, 1916, vol. xlv, p. 278.

³ Graefe's Archiv f. Ophthalmologie, 1915, vol. xc, p. 354.

A modified, or substitute, method is recommended by Shanker.¹ The conjunctiva is divided at the limbus, undermined, drawn over the cornea, and stitched together. Or, if it is a large staphyloma, this may be excised and the conjunctiva brought over the closed corneal wound. The conjunctiva is then tattooed, or an emulsion of the substance used is injected subconjunctivally, or is spread upon the cornea before the conjunctiva is stitched over it. For the tattooing, Shanker uses the fine lamp-black obtained from burning castor oil in a lamp. The color increases as the conjunctiva becomes more closely adherent to the cornea; and the redness passes off, leaving the conjunctiva transparent. The effect of such tattooing is said to last longer than when the material is pricked into the cornea, and probably the covering of conjunctiva lessens the chances of subsequent infection, making the eye safer.

PUPIL, UVEAL TRACT, AND GLAUCOMA.

Argyll-Robertson Pupil. The loss of the pupil reflex to light is evidently connected with a degenerative change in some particular part of the nervous system. But the exact location of the lesion that causes this symptom is still unsettled. The clinical association of loss of the light reflex (reflex pupillary rigidity—Argyll-Robertson phenomenon) with chronic syphilitic disease of the central nervous system is very general. But it would be quite peculiar if a certain part of the nervous apparatus were disturbed only in syphilis.

Mayer² has called attention to the occurrence of this symptom in alcoholism; and Jacobs³, from a careful review of the literature of the subject, finds that alcohol produces tissue changes allied to those found in syphilis, which may be associated with the Argyll-Robertson phenomenon. He points out that the glial proliferation found in the brain in chronic alcoholism, if sufficient in degree, would represent what occurs in tabes and paralysis; and the slow pupil found in alcoholics may indicate that the difference between that and loss of light reflex, is only one of degree. However, Jacobs is careful to point out that there is no reason to doubt the close relationship between lues and this symptom.

Causes of Iritis. Nearly all cases of uveitis are manifestations of some general condition, or arise secondary to a focus of infection in some other part of the body. But it is still common for cases of iritis to come to the oculist from the general practitioner, having received the correct local treatment, which was ineffective because nothing had been done to remedy the underlying condition. It has been said before, but requires repetition, that it is a more serious error to neglect the general treatment of iritis, than to neglect the local treatment. Advances in our knowledge of this subject, that make general treatment possible, have been noted in each June volume of *PROGRESSIVE MEDICINE* for the last five years. But the paper of most substantial value in this direction, that has yet appeared, is that of Brown and Irons.⁴ This

¹ *Ophthalmoscope*, 1916, vol. xiv, p. 600.

² *PROGRESSIVE MEDICINE*, September, 1916, p. 375.

³ *Journal of Missouri State Medical Association*, June, 1916, p. 277.

⁴ *Transactions of American Ophthalmological Society*, 1916, p. 495.

paper is especially valuable because of the thorough way in which each of the 100 cases of iritis on which it was based have been studied. "A complete physical examination was made to detect the presence of syphilis, tuberculosis, gonococcal infection, and infections of teeth, tonsils, sinuses, prostate, pelvis, or other structures, which might give rise to lesions in joints or eyes. Laboratory examinations, included Wassermann tests (98 patients) controlled by two laboratories; complement-fixation tests for gonococcal infection, radiographs of teeth and sinuses, and of the lungs, when there was any question of pulmonary disease; cultures of pus from tonsils, sinuses, prostate, and other infected tissues. Tuberculin tests, using 1, 3, 5, 10 mgm., were made in suitable cases."

The results of such complete clinical investigations have a value far superior to the statements repeated in most text-books regarding the etiology of iritis. The following table summarizes the causes of iritis in the 100 cases:

	Alone.	With other infections.	Total.	Coincident infections.						
				Syphilis.	Gonorrheal.	Tuberculosis.	Dental.	Tonsillar.	Sinus.	Genito-urinary.
Syphilis	10	13	23	..	8	5	5	1	1	
Gonococcal infection	7	2	9	..	..	..	1	1		
Tuberculosis	8	..	8	..	..	..	..	..	..
Dental infection	7	11	18	2	2	2	..	7	1	
Tonsillar infection	7	9	16	1	3	2	7	..	..
Sinus infection	1	2	3	..	..	..	1	1		
Genito-urinary (non-ven.) . .	3	..	3	..	..	..	1	..	..
Other infections	2	..	2	..	..	..	..	..	..
No cause found	1	..	1	..	..	..	..	..	..
Combined infections . . . . .	..	..	17	8	9	7	8	13	5	1
			100							

It is to be noted that while syphilis still ranks as the most common cause of iritis, it is not the cause of one-half or one-third of all cases. Next to it comes tuberculosis. This does not mean that 8 per cent. of all cases of iritis present the formerly recognized picture of tubercles in the iris, but rather that cases of iritis heretofore not so regarded are really tuberculous in origin. Taken together, the local infections—gonorrheal, dental, and tonsillar—are the most common causes of inflammation of the iris. They were present alone in 21, and in conjunction with other infections in 22 cases.

The combined infections offer a difficult problem for discrimination and judgment; but in general the safest policy will be to combat all factors that might enter into the causation of the case. It often happens that disease arises only when two or more factors coöperate; and sometimes one factor can be removed and the iritis cured, although other factors continue present. Three of the patients of this series had diabetes. But, in addition, one had an alveolar abscess, one a tonsil abscess, and the third tuberculosis and syphilis in addition to tonsillar infection. It still appears that "idiopathic" iritis must be recognized, since in one case of this series no adequate cause was found.

Probably acute infections have more importance in this connection than would appear from the above table. Morax¹ reports a case in which iritis complicated an intestinal infection, dysenteric in form, but apparently not amebic, or due to the bacillus of Shiga. The iritis developed with symptoms of general infection of the eye, after the acute stage of the dysentery had passed. It ran a relatively benign course, leaving the eye without permanent damage. Morax cites a case similar in these respects from the literature.

Bell² saw a case of bilateral kerato-iritis with fibrinous exudate in the anterior chamber in a child, aged seven years, who had just recovered from an attack of grippe. Other causes for the iritis seemed to be excluded. Ridley³ has reported a case of chronic iridocyclitis due to pneumococcal infection. Patches of the iris were particularly involved, other parts apparently free from disease. The blood gave pure cultures of pneumococcus. Ridley points out that this organism is particularly apt to get into the blood stream from local foci, and thus to reach the highly vascular uveal tract.

Hilbert⁴ reports iritis, with anterior synechia that broke up under atropine, as part of the general inflammation in the eye following the getting into the eye of the milky juice of *chelidonium majus*, which is sometimes used to remove warts. The immunity from iritis of the Egyptian fellahin is the subject of comment by Oulton,⁵ who suggests that since nearly all have suffered from trachoma in childhood, with hypertrophy of the conjunctiva and other tissues, this may enable the eye to better withstand microbic invasion.

Choroidal Tuberculosis. The classic forms of tuberculous disease of the choroid are two: The large, tumor-like mass of slow growth, a rare condition, and the miliary tubercles, which of late years have been found to be quite common, at the terminal stage of tuberculous meningitis or generalized miliary tuberculosis. The statistics on the subject, as brought together by Bredeck,⁶ vary extremely, from none in Heintzel's 41 cases, to 100 per cent. in Marple's 13 cases. In the last days or hours of life, tubercles form rapidly. Marple told of one found at 10 P.M. that was not visible at 6 P.M. The search for them has been greatly facilitated by the electric ophthalmoscope, and, if their presence has any importance in the diagnosis, they should be searched for daily with this instrument, and with the pupil well dilated. Randolph and Schmeisser⁷ have pointed out that statistics based on infrequent examination of the choroid have very little value. These authors report 2 cases observed ophthalmoscopically and confirmed by autopsy and microscopic examination.

But it is pointed out by Jackson⁸ that choroidal tuberculosis is not confined to these two classes of cases. Probably many cases occur in

¹ Annales d'Oculistique, January, 1917, p. 45.

² Archives of Ophthalmology, 1916, vol. xlv, p. 592.

³ Ophthalmoscope, 1916, vol. xiv, p. 232.

⁴ American Journal of Ophthalmology, December, 1916, p. 365.

⁵ Bulletin of Ophthalmological Society of Egypt, 1915, p. 23.

⁶ American Journal of Ophthalmology, January, 1916, p. 1.

⁷ Transactions of American Ophthalmological Society, 1916, p. 585.

⁸ Ophthalmic Record, January, 1916, p. 1.

chronic tuberculosis which for a few days present some of the classical appearances of miliary tubercle of the choroid and then go on to recovery, leaving the scar of choroidal atrophy with pigmentation. The condition is also apt to be overlooked because the patient often is not suffering from marked pulmonary or general tuberculosis. The fact that a large proportion of people in fair health have been infected with tuberculosis make it certain that many cases of tuberculosis of the choroid will escape recognition, if it is only thought of in connection with those who are manifestly ill with tuberculosis of some other organ. In the treatment, it is urged that tuberculin has a high value for ocular tuberculosis, but that it should be given in comparatively small doses and at intervals of one to four weeks, with the eye carefully watched for focal reactions. A focal reaction may be very evident by lowered vision or increased hyperemia and swelling, even by hemorrhage, when no rise of temperature or other evidence of a general reaction is manifest.

Sympathetic Ophthalmia. This disease continues to be a fruitful subject for theoretical discussion. Dunn¹ thinks that every ophthalmologist is agreed that it is not due to "sympathy" but to a process of infectious origin. He would have the term replaced in all books on ophthalmology by "infective cyclitis" or "infective ophthalmitis." But it differs strikingly from other infections, and the indefinite term "sympathetic" may serve to call attention to this difference. Dunn believes the disease has become less common and less dangerous of late years; and this he connects with the aseptic and antiseptic treatment of wounds.

The value of prolonged administration of mercury in controlling inflammation and bringing about partial restoration of vision, when sympathetic inflammation has actually occurred, has been illustrated in the writer's practice within the last year. In this case, calomel was used in one-tenth grain doses two or three times a day for several months, suspending it for a time when it affected the gums. The proprietary preparation of mercury known as "embarin," which is especially prepared for hypodermic use, has been favorably mentioned by Hirsch.²

Glaucoma. The experiments of Hertel³ on the modifications of intra-ocular tension by changes in the composition of the blood have been previously referred to. These he⁴ has now supplemented by clinical observations on relatively young subjects with glaucomatous rise of tension. He found that the concentration of the blood in these patients was essentially lower than in persons free from glaucoma, and he believes that this may dispose to increased intra-ocular tension. In one case where the concentration of the blood was found to be higher during a glaucomatous attack, he thinks that may have been caused by vasomotor changes from psychic causes, or sudden cooling of the surface. He points out that the favorable effects of warm baths and venesection in the relief of glaucomatous outbreaks may be due to thinning of the

¹ *Lancet*, March 18, 1916, p. 620.

² *Medizinische Klinik*, 1916, vol. xii, p. 123.

³ *PROGRESSIVE MEDICINE*, June, 1915, p. 425.

⁴ *Graefe's Archiv f. Ophth.*, 1915, vol. xc, p. 309.

blood. He suggests intravenous injections of concentrated salt solution, to rapidly decrease the intra-ocular tension as a preliminary to glaucoma operations.

This matter of the relation of blood-pressure to intra-ocular tension is, however, far from settled. What is spoken of as a patient's blood-pressure is usually the pressure in his brachial artery. This, as is pointed out by Moore,¹ may be totally different from the blood-pressure in a retinal artery, less than one-tenth of a millimeter in diameter. Arterial spasm that would tend to raise the blood-pressure in the large vessels would diminish it in the capillaries of the eye. Experimental investigations suggest new points of view and new ideas regarding glaucoma. But they do not yet afford any consistent theory of this disease.

THE CRYSTALLINE LENS.

Causes of Cataract. Considering the importance of cataract, and the length of time it has been recognized and studied clinically, very little is known about its causation. Glass-workers' cataract has been ascribed to heat, and other forms of cataract to the so-called *abiotic ultraviolet rays*, which are absorbed in passing through the ocular media and probably converted into heat. Chemical examination of cataractous lenses has seemed to show certain salts of sodium, calcium, and magnesium in marked excess, as compared with the normal lens; and in cataracts from India the presence of a large amount of silicon.²

Burge³ found that exposure of egg albumen for thirty hours to the quartz mercury vapor lamp left it transparent and apparently unchanged. But, when it was subjected to a solution of calcium chloride or calcium nitrate, the portion exposed coagulated, while the other parts still remained unchanged. The albumin from the crystalline lens was subjected to the same influences with the same result. The part that had been exposed was coagulated, while other parts of it were not. The lens substance absorbed all wave-lengths shorter than $313\ \mu$. Fish living in tap water, and others living in water to which sodium and calcium silicates had been added, were exposed to the quartz mercury vapor radiations, two exposures of six hours each. In those living in the tap water, the lens remained clear. In those living in sodium and calcium solutions, the exposed lens became opaque, the unexposed lens in the other eye remaining clear. In this way it was possible to produce complete cataract in the fish. The microscopic appearances of *paramecia* killed by thirty or forty minutes' exposure to ultraviolet radiations, was similar to *paramecia* killed by heating to a temperature of 45°C .

Verhoeff and Bell,⁴ experimenting on the eyes of mammals, were unable to produce opacity of the crystalline lens by even severe exposures one and one-half hours to the abiotic radiations. But after a lens so exposed was placed in salt solution, the part of it corresponding

¹ British Medical Journal, May 13, 1916.

² PROGRESSIVE MEDICINE, June, 1910, p. 338.

³ Abstract-Bulletin Nela Research Laboratory, 1917, p. 290.

⁴ Proceedings of American Academy of Arts and Sciences, 1916, vol. li, p. 671.

to the pupillary area became hazy. Histological examination revealed no change in the capsule of the lens, but marked changes in the capsular epithelium, and change in a very thin layer of the lens substance, immediately beneath the epithelium. The histological changes noticed in the capsular epithelial cells included swelling, the appearance of granules in the cytoplasm, and even disintegration of the nucleus.

These observations on the effect of abiotic radiations seem to suggest that light from artificial sources, which is relatively rich in such rays, as compared with daylight, may have a tendency to produce cataract. But they also seem to show that such tendency fails to operate, unless there is present an abnormally high percentage of sodium or calcium salts, the amount of which is likely to depend on conditions of general nutrition.

Three cases of CATARACT ARISING DURING PREGNANCY are reported by Miceli.¹ In one patient the condition was confined to the right eye, and rapidly increased until vision was reduced to counting fingers at one meter. Abortion at the end of the fourth month was followed by improvement within ten days to counting fingers at two meters. But the subsequent course could not be followed. In the second case vision was reduced to light perception in the right eye, the left eye remaining normal. There was milky opacity of the right lens, which became more dense during the following month. This patient aborted at the end of the third month, and the cataract was subsequently removed with good result. In the third case the cataract became complete in the right eye within two months, and at the beginning of the fourth month this patient died of eclampsia. Miceli concludes that such development of cataract in early pregnancy, coincident with increase in the amino-acids in the urine, indicates a gravidic toxicosis that calls for radical treatment, including the termination of pregnancy.

Treatment of Partial Cataract. For the patient the important thing is, not the mere presence or form of opacities in the crystalline lens, or the theoretic impairment of vision they cause; but the disability for accustomed occupation thus entailed. If, with care and moderation, the patient can continue his occupation, he will not be greatly disturbed by the fact that some lens opacity continues to exist. For a large proportion of cases of partial cataract, such a desirable condition is possible often for long periods or to the end of life.

Brown² reports 3 such cases. One patient was a church organist, disabled by the condition of his lens, which was swollen, cloudy, and presented spoke-like opacities extending from the periphery, but not yet invading the center. Vision: right eye, 5/45; left eye, 5/30. He was prevailed upon to give up attempts to do his work, for which he was incapacitated, and to try to build up his general health. At the end of a year he still had his lens opacities, but they had altered so that he got vision of: right eye, 5/9 plus; left eye, 5/9; and he was able again to take up his work. A year after that he continued to do his work regularly with vision: right eye, 5/5; left eye, 5/5(?).

¹ *Annali di Ottalmologia*, 1915, vol. xlv, p. 385.

² *Annals of Ophthalmology*, 1916, vol. xxv, p. 457.

A second case was that of a seamstress, who, after a diagnosis of cataract and warning to prepare for operation, under careful and repeated correction of her refractive errors was able to continue her work with vision of right eye 5/12 and left eye 5/15 after eleven years. The third patient, also by careful and repeated adjustment of glasses, was able, eleven years after the recognition of cataract, to continue the use of her eyes with vision of right eye 5/12 and left eye 5/7.5.

In addition to the more generally used measures for checking the development of cataract, such as the correction of "faults of diet, digestion, drinking, bathing, thinking, and exercise," Bissell¹ has restricted his patients in the use of salt, with advantage. He was led to this by observing cataracts in excessive users of salt, and seeing marked clearing of the lens follow the correction of its immoderate use. This would agree with the observations of Burge, under pathogenesis of cataract, regarding the effect of sodium salts on the causation of experimental cataract.

EXTRACTION OF CATARACT IN THE CAPSULE. This procedure continues to be warmly recommended by its partisans, and regarded with skepticism by the majority of operators. The most important suggestion regarding it in the past year is the method of Török.² He makes an incision encircling about one-half the cornea, and does a small iridec-tomy. Then the Kalt capsule forceps held in the left hand are introduced into the anterior chamber, while with the right hand a Daviel lens spoon is applied below the lower limbus. With light pressure the capsule is grasped in the forceps, and with a few lateral and circular movements the zonular attachments are loosened. Keeping up the lateral movements and a slight forward traction with the forceps, the spoon is applied to the sclera with gentle intermittent pressure, until the sclera is slightly indented, when the pressure is withdrawn. This is repeated several times, moving the sclera about as the wall of a pulsating artery; until the zonule is ruptured below, and the lower edge of the lens slowly emerges from behind the iris. The forceps are now slowly moved toward the corneal wound and continuous pressure made with the spoon until the lens is delivered, lower edge first. This method, tried in 53 cases, succeeded in 37, and in 6 others the capsule was withdrawn with the forceps after its rupture. In 5 cases of immature cataract, the forceps slipped off the capsule, and, in 5, the capsule ruptured, and an ordinary Graefe operation was done. In 4 cases there was delayed union, and in the others recovery was quick and uneventful.

TREATMENT AFTER CATARACT OPERATION. The results of the ambulant after-treatment of cataract, as described by Bruns,³ who reports the use of this method in 232 unselected hospital cases in the course of eight years, showed 18 failures, 7+ per cent. But, in the same hospital service, 371 cases confined to bed after operation showed 39 failures, or 10+ per cent. The dressing used consisted of two disks of gauze fastened about the rim of the orbit and side of the nose with collodion;

¹ Ophthalmic Record, 1916, vol. xxv, p. 346.

² Transactions of American Ophthalmological Society, 1916, p. 492.

³ Ibid., p. 473.

and over this a cataract cage of wire, fastened on by a figure-of-eight mosquito-net bandage. In the absence of pain, this was not removed for forty-eight to seventy-two hours; and after that the eye was often covered with the cataract cage only, under which the natural movements of the lids promoted cleanliness.

POSTOPERATIVE DELIRIUM AND EFFECTS OF ALCOHOL. Under the treatment above described by Bruns, no case of postoperative delirium was encountered. Fuchs¹ has seen scarcely any cases of such delirium since he omitted all bandages from the unoperated eye after the day of operation; and since he permitted users of alcoholic beverages to be given some alcohol in the form of wine, during the after-treatment. He reports 2 cases of patients with bilateral cataract, who had been previously half-demented, whose mental condition improved strikingly after restoration of vision by cataract extraction.

Posey² thinks that previous use of alcohol is responsible for a number of cases of postoperative delirium; but a more important influence is the mental effect of operation and subsequent confinement. He calls attention to the influence of alcohol in setting up uveitis after cataract extraction in eyes that had previously been doing well. He gives 2 cases in which a uveitis, with filling of the vitreous with flocculent material, had been developed four or five days after the operation.

RETINA, OPTIC NERVE, VISUAL TRACTS AND CENTERS.

Retinal Aneurysm. A few descriptions, in the older literature, of aneurysm of the retinal arteries have been quoted or referred to, until an impression has arisen that such lesions are more frequent than they really are. Aneurysms of the retinal arteries are extremely rare. Irregular dilatations of the arteries occasionally occur in general disease of the retinal vessels, with arteriosclerosis or renal disease. More like true aneurysms are the rounded swellings connected with the larger vessels in retinal angiomatosis; and multiple miliary aneurysms are found in a disease described by Leber. But both of these diseases are very rare.

A case of what appeared to be true aneurysm of branches of the central retinal artery is described by Pringle.³ The patient was a healthy man, aged twenty-three, who had worked four years in a coal mine, and had suffered from nystagmus. He had no history of tuberculosis or syphilis, and his family history was negative. The swellings on the artery were two to four times the diameter of the vessel, and resembled the bulbs on a rubber-bulb syringe. In the left eye a series of such dilatations were found on a branch that passed above the macula. In the right eye, 23 such dilatations were discovered on the lower temporal and nasal arteries. Most of them were in the extreme periphery of the fundus, where they were more difficult to observe on account of the nystagmus. They showed no spontaneous pulsation, and very slight

¹ Centralbl. f. praktische Augenheilkunde, December, 1915, p. 206.

² Ophthalmic Record, 1916, vol. xxv, p. 255.

³ British Journal of Ophthalmology, 1917, vol. i, p. 87.

pulsation was obtainable by pressure on the eyeball, which, however, diminished the size of the swellings. Pringle believes the condition was congenital. This hypothesis was supported by the presence of opaque nerve fibers above the macula in the left eye, and by an anomalous increase of connective tissue around the optic disk.

Night-blindness. As suggested last year,¹ this is a symptom of varied conditions. Among its recognized causes, El Rasheed² calls attention to retinitis pigmentosa with, or without, fundus pigment, the congenital hereditary stationary form, myopia, liver disease and diarrhea, malnutrition and deficiency of body fat, and the effects of glare. In his service at Assiout, he encountered 52 cases, of which 8 were due to retinitis pigmentosa and 2 were congenital. In 4, the symptom was associated with myopia. For the more common cases of malnutrition with, or without, disease of the liver, the treatment is good feeding, cod-liver oil or roasted liver with meals; and wearing dark glasses. Early cases are curable; but, for very chronic cases, the prognosis is doubtful.

Night-blindness is a favorite claim of malingerers, and, when not connected with retinitis pigmentosa, it is difficult to exclude simulation. Birch-Hirschfeld³ thinks that when visual acuity is not reduced more than one-fourth, the patient is not incapacitated for military service; but he should be watched by the army surgeon, and not detailed for night duty. He encountered 140 cases among 10,000 patients. In 108, it had existed before the war began; 60 patients had myopia which was assumed to be a cause of nyctalopia. *Heredity* was traced in one-third of the cases. Of 49 patients under observation several weeks, only 8 showed marked improvement. In the acute cases the prognosis is more favorable. Here, hemorrhage, emaciation, malnutrition, and poisons operate, and light dazzling usually initiates the attack.

It might be questioned if a symptom of such varied conditions as seem to underlie night-blindness should be separately considered. But a pedigree of the hereditary form reported by Smith and Usher⁴ illustrates the practical importance of so considering it. They report a case of choroideremia, and two other varieties of night-blindness, occurring in the same family. A woman with retinitis pigmentosa married a man with congenital stationary night-blindness. The first child, a girl, and the second, a boy, were normal. The third, a boy, had a general absence of pigment and extremely defective choroids; while the fourth child, a girl, showed the appearances of retinitis pigmentosa. In the father and his maternal uncle, were found hereditary stationary night-blindness—the symptom that should have warned against such a mating.

Tuberculosis of the Retinal Vessels. Now that recurring intra-ocular hemorrhage in young persons, and the proliferating retinitis that follows, are recognized as due to tuberculosis, the number of cases reported is increasing. Spencer⁵ has reported 3 cases, and has brought together

¹ PROGRESSIVE MEDICINE, June, 1916, p. 463.

² Bulletin of Ophthalmological Society, Egypt, 1915, p. 16.

³ Journal of American Medical Association, 1916, vol. lxxvii, p. 1952.

⁴ Royal London Ophthalmic Hospital Reports, 1915, vol. xx, p. 157.

⁵ Ophthalmology, 1917, vol. xiii, p. 225.

from the literature some 29 others, having excluded all doubtful cases. One of Spencer's patients was a farmer who felt so well that he declined treatment. The second patient, a woman, was suffering from active pulmonary tuberculosis, and had previously suffered from abscess of the kidney. The third patient was a young man with no evidence of general tuberculosis, except that he gave the tuberculin reaction, and had been run down. In each of these latter cases, blood, Wassermann, and huetin tests were negative. Relapses are frequent in all forms of ocular tuberculosis, and this is particularly true of cases of relapsing intra-ocular hemorrhage. Even after cure appears complete, recurrences may arise, so that it is not safe to count the case cured until after three years. In the treatment, all methods known to favorably influence the tuberculous process in general are appropriate, especially the tuberculin treatment. This should be given in doses so small as to excite little, or no, reaction, and at relatively long intervals, and the series extended over many months.

Familial Progressive Macular Degeneration. Hereditary or familial diseases have a wider interest than arises from the locality in which they occur. Feingold¹ reports 3 cases of progressive macular degeneration occurring in the offspring of first cousins, Russian Jews. Six other children of the same parents had healthy eyes. The lesions varied in shape in the different patients, but were always strikingly symmetrical in the two eyes of the same patient. This seems to indicate that the cause was some congenital weakness of the macular region. This view was confirmed by other inherited ocular stigmata found in the same family. These were color-blindness, affecting all the sons, and a posterior polar cataract in the mother. Vision was not greatly affected, 5/6 to 5/10. The macula generally presented two zones, the peripheral portion lighter than the surrounding fundus, and the central area darker.

Wood-alcohol Amblyopia. The importance of methyl-alcohol poisoning increases with its larger use in the arts, and with the exclusion of ethyl alcohol in beverages from an increasingly large territory. Allport² points out the general inefficiency of laws, relating to this subject, that have been enacted in thirty-one States. Wood alcohol is on the market in three forms. The raw, foul-smelling original product is so disgusting that there is no temptation to drink it. The same is largely true of the denatured alcohol, which is one part wood alcohol to nine of ethyl alcohol. But the "deodorized" or "purified" wood alcohol is cheap, and tastes and smells enough like ethyl alcohol to make it very dangerous. Allport thinks it should not be made. Or, if necessary for certain purposes in manufacturing, it should be sold only to those engaged in such manufactures, and never at retail. Effective laws based upon these facts are urgently needed.

It is stated by Eleonskaia³ that after the sale of liquor was forbidden, 14,032 cases of poisoning by denatured and wood alcohol occurred in Petrograd, of which 6 per cent. resulted in amblyopia. The disturb-

¹ Transactions of Section of Ophthalmology of American Medical Association, 1916, p. 312.

² Ophthalmology, 1916, vol. xii, p. 618.

³ Journal of American Medical Association, 1916, vol. lxvi, p. 1897.

ances from denatured alcohol are milder than those from pure alcohol, but more severe than are produced by ethyl alcohol.

Ethylhydrocuprein Amblyopia. From its close chemical similarity to quinine, ethylhydrocuprein (optochin) might have been expected to cause amblyopia. But the fear of such an effect has not been sufficient to prevent a strikingly large number of cases of impairment of vision from the new drug. Perhaps this is because ethylhydrocuprein is dangerous in smaller doses than is quinine. Weeks¹ 2 cases of quinine amblyopia received large doses. A woman receiving probably 150 grains per rectum, and a girl of six taking probably 100 grains, or upward, in three days. But in his case of ethylhydrocuprein poisoning, a girl, aged sixteen years, had taken about 30 grains in as many hours. The patient was entirely blind for about six days, then vision slowly improved until in six months it was 20/30, in each eye, with great narrowing in the fields of vision, and "very indefinite" color vision. The optic disks were pale, the retinal arteries reduced in caliber and accompanied by white lines. The symptoms in all respects closely resembled those of quinine amblyopia.

Adler² has found the danger of serious impairment of vision so great, from therapeutic doses of the drug, that he does not feel justified in using or recommending it until its effects have been further studied. He reports 3 cases. In one, the blindness lasted twelve hours and severe permanent damage was left. In the second case the drug was stopped at the first sign of trouble. But the amaurosis became complete the next day and lasted for several months, although at the end of a year the vision became normal. Both of these patients were young women. In a child, aged two years, the amaurosis was complete and lasted for a week. The amount of "optochin" taken was only $\frac{1}{2}$ gram.

Feilchenfeld's³ patient, aged twenty years, received 5 grams in twenty-four hours. Within two days hearing and sight were impaired, and complete blindness set in the next day. Vision gradually returned to 6/6, but with concentric contraction of the fields and a large paracentral scotoma. The ophthalmoscope showed optic atrophy.

Numerous other cases of serious amblyopia following the use of this drug have been recorded, so that the danger attending its use is pretty well established. Oliver⁴ thinks it should not be given internally. His patient received 5 grains at a dose every three hours, until 120 grains were taken. Light perception was lost, after which vision improved; but fell again to 6/60 with the fields much contracted, and the optic disks perfectly white. The patient was left unable to earn his living.

Papilledema and Optic Neuritis. The question whether these are essentially one condition, or different in nature and etiology, has been much debated in the literature referring to them. The general consensus of present opinion favors the latter view. The leading facts bearing upon it are presented by Hardy.⁵ He holds they are etiologically dis-

¹ Transactions of American Ophthalmological Society, 1916, p. 593.

² *Therapeutische Monatsschrift*, September, 1916, p. 420.

³ *Deutsche medizinische Wochenschrift*, March 16, 1916.

⁴ *British Medical Journal*, April 22, 1916, p. 580.

⁵ *American Journal of Ophthalmology*, 1916, vol. xxxiii, p. 353.

tinct entities, and that inability to distinguish clinically between the two conditions does not necessarily imply their identity. Optic neuritis is primarily and essentially an inflammatory process; choked disk is an edema and lymph stasis, the result of increased intracranial tension. Renal choked disk, the special subject of Hardy's paper, may be a mixed form, both processes, inflammation and lymph stasis, being exemplified. He reports a case in which decompression was done, followed by slow subsidence of the swelling of the nerve heads, but without marked improvement of vision or the general condition.

Elsberg¹ considers papilledema to be due to ocular pressure, and calls attention to the rapidity with which it may occur. A woman with symptoms of brain tumor was found to have normal eye-grounds, and only three days later presented swellings of her optic disks of nearly 6 D. The edema may subside with equal rapidity. Twenty-four hours after this patient was operated upon, the swelling was reduced to 1 D.

In his ophthalmoscopic work in a British base hospital, Greenwood² noted equally rapid changes in the edema of the optic nerve and retina attending "trench nephritis," a condition which he thinks results from lessening of the skin elimination, from standing for days in water-soaked clothing; and often in water up to the waist. These patients improved rapidly when brought into the hospital, and, after the subsidence of the general edema, no ophthalmoscopic changes were found. He therefore examined 6 cases when brought into the hospital, and before they were put to bed, at 2 o'clock in the morning. Five showed marked fundus changes, along with general edema. The sixth had very little edema, and normal eye-grounds. After six and one-half hours' rest in bed, all showed marked decrease in the fundus changes. Twelve hours later, 2 cases had become normal, 2 still showed slight neuritis, and the fifth a very slight edema. Twelve hours after that, with a full night's sleep, all the eyes appeared normal.

In this hospital service many perforating and furrow *injuries of the skull* were operated on to remove splinters of bone and secure suitable drainage. Following such operations, increased cerebral pressure brought rapid choking of the disk, which would subside as rapidly with renewal of drainage. The surgeons came to depend on frequent reports of the fundus examinations as a guide to the necessity for reopening the cranial wounds.

Optic Atrophy with Lesions of Chiasm. In a series of 81 cases of impairment of the visual field due to pressure upon the chiasm from swelling in the region of the hypophysis, Walker and Cushing³ had the opportunity of making histological studies of the effected nerve tracts in 8 cases. These included temporal hemianopsia, homonymous hemianopsia, irregular loss of the peripheral field, and complete blindness of one or both eyes. They conclude that although there may be atrophic pallor of the optic disk with the defect of the field, histological examination fails to show a corresponding degree of degeneration of

¹ Surgery, Gynecology and Obstetrics, August, 1916, p. 153.

² Transactions of American Ophthalmological Society, 1916, p. 529.

³ Archives of Ophthalmology, 1916, vol. xlv, p. 407.

the nerve fibers, unless the process has been of long duration. Atrophy in the tracts antedates that in the nerves, where the fibers may be preserved by their retinal ganglion cells after years of complete functional blindness.

When atrophy of the nerve fibers is found, there is no sharp delineation of the process to correspond to the sharply cut hemianopsias. This is in accord with the fact that perimetric observations with graded disks show that the boundaries of the visual field, or the seeing areas within it, are less sharply cut than had previously been supposed. They correspond better with the diffuse picture of atrophy in the nerves.

Cortical Representation of the Retina. To put on record the effects on the visual field of injuries to the head received in the present war, has left little time for extended comparison and the drawing of general conclusions. Lister and Holmes,¹ from an experience of over 2000 cases of head injury, covering eighteen months in base hospitals, have, with some reserve as to future amendment, formulated the following: They have no evidence that achromatopsia, with intact vision for white, is produced by lesions of the cortical center or optic radiations. The upper half of each retina is represented in the dorsal, and the lower half in the ventral, portion of each visual area. The center for macular vision lies in the posterior extremities of the visual areas, probably on the margins and lateral surfaces of the occipital lobes. The upper quadrant of the retina adjoining the fovea is represented in the upper, posterior part of the visual area in the opposite hemisphere. The periphery of the retina is probably represented in the anterior end of the visual area; and serial concentric zones of retina from macula to periphery are probably represented in the visual area by successive regions from behind forward.

The studies of Marie and Chatelin,² while less complete, in the main support the conclusions given above. They saw 5 cases of inferior hemianopsia in soldiers wounded in the median line above the occipital protuberance. They believe they met with 1 case of hemiachromatopsia, vision for colors being lost in the left lateral field, but they admit that this condition is very rare.

LIDS, LACRIMAL APPARATUS AND ORBIT.

Ptosis. Ptosis, the insufficient raising of the upper lid, depends upon so many causes, varies so greatly as to pathological conditions present, that no one operation can be applicable to all cases. Even the statement of Calderaro³ that no operation is satisfactory which does not substitute the action of another muscle for that of the defective elevator must be regarded as too sweeping. It may be admitted, however, that the most satisfactory cases for operative treatment are those in which the frontalis, or the superior rectus muscle, can be made to take over the work of elevating the lid. The latter plan as accomplished by

¹ Section on Ophthalmology, Royal Society of Medicine, March 22, 1916.

² Bulletin de l'acad. de méd., 1916, vol. lxxiv, p. 535.

³ La Clinica Oculistica, 1915, vol. xv, p. 321.

the operation of Mottais seems to be growing in favor. Within the last year reports of its successful use have been published by Heed¹ and others in discussing his communication, and by Shine.² The latter reports 6 cases and points out these advantages. It is done subconjunctivally inside the lid; avoiding the external scars and disfigurement that follow some of the other operations, and leaving a normal appearance. It is easily performed under a local anesthetic. No other function of the lid is interfered with; and, if not successful, it does not complicate any other operation that may be tried. The cases for which it is best suited are those of partial, congenital ptosis, with full power of elevating the eyeball; slight traumatic ptosis, without thickening of the lid; and cases in which the affected eye is amblyopic, so that there is no danger of diplopia.

The operation is best done under local anesthesia. The superior rectus is fully exposed, the conjunctiva retracted and a vertical incision carried up to the fornix and on to the lid as far forward as the posterior margin of the cartilage. With fine-pointed scissors an opening is made in the tendon of the elevator of the lid, and a tunnel formed between the cartilage and skin from the posterior border of the tarsus to near the margin of the lid, broad enough to allow plenty of room to introduce the slip of tendon. This slip is obtained by raising the tendon of the superior rectus on a strabismus hook, and introducing through the middle of it a suture with a needle on each end. The tendon is then split for 10 to 12 mm. back from the insertion, on both sides of the central slip at least 3 mm. wide which is then separated from the eyeball. The needles are then passed through the tunnel in the upper lid, and brought out just above the cilia, near the center of the lid margin but about 4 mm. apart. The slip is pulled well into place in the tunnel, and the suture tied over a roll of gauze on the skin surface. The conjunctival incision is closed with one or more sutures. Both eyes are bandaged for two days to prevent lid movements.

Lacrimal Obstruction. In the treatment of lacrimal disease, more than in many other surgical procedures, success depends on attention to minute details. In a valuable discussion of details, Gifford³ states that when he slits a caniculus it is generally the upper. This is a little more difficult to slit, but it makes subsequent probing easier. Success in reopening the lacrimal passage by probing depends on keeping on with the probing long enough. If the patient lives at a distance, either he, or his attending physician, must be taught to pass the probe, to insure the necessary continuance of the treatment. In introducing the probe into the canal, this simple maneuver has often brought success where, without it, he would have failed. After passing the probe in horizontally until the point is in contact with the bone, he would turn the point, as far as it would go, up and back along the inner wall of the sac, before attempting to follow down the inner wall. Sometimes,

¹ Transactions of College of Physicians of Philadelphia, 1915, vol. xxxvii, p. 405.

² Transactions of American Ophthalmological Society, 1916, p. 733.

³ Transactions of Fourth Annual Meeting of Pacific Coast Oto-Ophthalmological Society, 1916, p. 48.

when the probe seems stuck in the midst of the canal, by twisting the free end over toward the median plane of the face, or occasionally by rotating it in the opposite direction, it will be found to pass freely onward.

When something more radical than probing is required, Gifford *destroys the sac with trichloroacetic acid*. This he has practised in 100 cases, with but one failure. In that case the crooked bony canal had to be opened up from the nasal side. In another case, the application of trichloroacetic acid had to be repeated once. The operation is done under local anesthesia, secured by injection of cocaine, and adrenalin into the tissues around the sac. An incision three-eighths of an inch long is made into the sac, dividing about one-half the width of the palpebral ligament. Oxide of zinc ointment or vaseline is put on the neighboring skin and the edges of the cut. The opening in the sac is then stretched by spring forceps, and from one to five drops of liquefied full-strength trichloroacetic acid is put into the sac with a narrow dropper. The sac is then thoroughly scrubbed with a cotton swab, one-eighth inch in diameter, on the end of a metal applicator; special attention being given to the opening into the duct and the upper extremity of the sac. After drying the sac, the swab is dipped in trichloroacetic acid, and the sac scrubbed with it a second time. Excess of acid is removed, and the cavity and incision packed with aristol powder. After applying zinc ointment to the skin, a dressing is applied.

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